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# Annual Report FY 2015

# AMAZON MALARIA INITIATIVE

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Annual Report FY 2015

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# ACRONYMS AND ABBREVIATIONS

ACS	Community Health Agent
ACT	Artemisinin-based Combination Therapy
AMI	Amazon Malaria Initiative
ARCSA	Ecuador's National Medicines Regulatory Agency
ASAZGUA	National Sugar Cane Association
CDC	United States Centers for Disease Control and Prevention
CHAI	Clinton Health Access Initiative
CNCC	Peru's National Center for Quality Control
CQ	Chloroquine
EMMIE	Elimination of Malaria in Mesoamerica and the Island of Hispaniola
EQAP	External Quality Assurance Program
GFATM	The Global Fund to Fight AIDS, Tuberculosis and Malaria
HRP2	Histidine-rich Protein 2
HRP3	Histidine-rich Protein 3
ICEMR	International Centers of Excellence for Malaria Research
INS	Peru's National Institute of Health
IRS	Indoor Residual Spraying
ITN	Insecticide-treated Net
IVM	Integrated Vector Management
K13	Kelch 13
LAC	Latin America and the Caribbean
LLIN	Long-lasting Insecticidal Net
MDG	Millenium Development Goal
MEI	Malaria Elimination Initiative
MRA	Medicines Regulatory Authority

MOH	Ministry of Health
MSH	Management Sciences for Health
MSPS	Colombia's Ministry of Health and Social Protection
NMCP	National Malaria Control Program
OMCL	Official Medicine Control Laboratory
PAHO	Pan American Health Organization
PCR	Polymerase Chain Reaction
PfHRP2	<i>P. falciparum</i> Histidine-rich Protein 2
PMI	United States President's Malaria Initiative
PQ	Primaquine
PQM	Promoting the Quality of Medicines Program
PRAIS	Regional Platform on Access and Innovation for Health Technologies
PRS	Pharmaceutical Reference Standards
QA/QC	Quality Assurance/Quality Control
RAAN	North Atlantic Autonomous Region of Nicaragua
RAAS	South Atlantic Autonomous Region of Nicaragua
RAVREDA	Amazon Network for the Surveillance of Antimalarial Drug Resistance
RBM	Roll Back Malaria
RDT	Rapid Diagnostic Test
SBCC	Social and Behavior Change Communication
SIAPS	Systems for Improved Access to Pharmaceuticals and Services Program
SOD	Strategic Orientation Document
SOP	Standard Operating Procedure
TA	Training and Technical Assistance
USAID	United States Agency for International Development
USP	United States Pharmacopeial Convention
VCS	Vector Control Services
WHO	World Health Organization

# EXECUTIVE SUMMARY



Photo: CIFOR

This Annual Progress Report covers Amazon Malaria Initiative activities completed from October 1, 2014 to February 28, 2016, which corresponds to all of Fiscal Year 2015 (FY 2015) and the first two quarters of Fiscal Year 2016 (FY 2016); and it is organized as follows:

1. Epidemiological Overview of Malaria in Latin America and the Caribbean (LAC)
2. Technical Areas of Intervention
3. Challenges and Opportunities

The Amazon Malaria Initiative (AMI) is a United States Agency for International Development (USAID) program, started in 2001 and for that reason the report provides context on the epidemiological trends in the Americas from 2000 to the present. AMI represents a collaborative effort between 11 countries' ministries of health (MOH) and implementing partners: Pan American Health Organization/World Health Organization (PAHO/WHO), the U.S. Centers for Disease Control and Prevention (CDC), Management Sciences for Health (MSH), the U.S. Pharmacopeial Convention (USP), and Links Media. This document functions as an overarching report that highlights AMI partners' contributions to improve malaria prevention and control in LAC from 2014–2016.

Implementing partners have provided training and technical assistance (TA) in the areas of efficacy of and resistance to antimalarials, diagnosis and treatment, quality assurance and control of pharmaceuticals and other supplies, vector control, epidemiological surveillance, networking, health systems strengthening, communication, advocacy, and information dissemination.

AMI's Strategic Objective is to assist malaria control programs in the Amazon basin and Central America to substantially incorporate selected best practices. AMI-supported countries in the LAC region during the reporting period included Belize, Brazil, Colombia, Ecuador, Guatemala, Guyana, Honduras, Nicaragua, Panama, Peru, and Suriname. AMI partners work to ensure that countries can effectively and efficiently address malaria through evidence-based activities, adoption and sharing of best practices, and collaboration through a regional network.

Six lines of work, or technical areas of intervention, have been carried out by AMI implementing partners, with cross-cutting support in communication focusing on advocacy, outreach, and dissemination of information. Principal highlights from FY 2015 to FY 2016 that are featured in this report include:

### **Monitoring of Efficacy and Resistance to Antimalarials, and Prevention of the Emergence of Resistance to Antimalarials**

Under risk of decreased parasite sensitivity to artemisinin-based therapies, *in vivo* studies were conducted in Brazil, Guyana, and Suriname in order to monitor changes in parasite clearance rates. AMI partners also followed WHO guidelines in the application of *in vitro* and molecular surveillance techniques to study the efficacy of other first line treatments currently in use. No evidence of artemisinin resistance was found in the region, however a decline in parasite sensitivity to the drug was observed in Suriname. Regional evidence review meetings and consultations led to the development of a *Framework for Artemisinin Resistance Containment and Elimination in South America*. Teams of local health professionals gained training and developed their research capacities by conducting antimalarial resistance and efficacy monitoring with support from AMI and the Amazon Network for the Surveillance of Antimalarial Drug Resistance (RAVREDA), and these teams are now capable of conducting efficacy trials in malaria-endemic countries.

## **Access to Quality Diagnosis and Treatment**

In the area of quality-assured malaria diagnosis, four rounds of a regional External Quality Assurance Program (EQAP) were carried out by the end of 2015 in order to develop and maintain national laboratory capacity for diagnosis via microscopy. A regional slide bank was established at the National Reference Laboratory in Honduras, which became available for lending to other countries in the region for microscopy trainings and refresher courses. Also, a multi-country survey of the prevalence of histidine-rich protein 2 (HRP2) gene deletion was supported in order to orient the procurement of accurate rapid diagnostic tests (RDTs) for malaria.

Regarding treatment, pharmaceutical programming and procurement criteria were developed to ensure maintenance of adequate antimalarial stock levels, including minimal strategic stock-levels in regions of endemic countries without active malaria transmission. PAHO/WHO also established a strategic warehouse in Panama that provided life-saving antimalarial treatments in case of urgent needs within the LAC region and beyond.

## **Quality Assurance and Control of Pharmaceuticals and Other Supplies for Malaria Prevention and Control**

Countries expanded and institutionalized pharmaceutical quality control protocols such as the Three Level Approach, which helps to guarantee the continuous availability of quality-assured medicines for malaria. Workshops for improved South–South collaboration among LAC countries, as well as engagement of academia and the private sector, were held to augment national pharmaceutical quality assurance networks beyond Medicines Regulatory Authorities (MRAs) and Official Medicines Control Laboratories (OMCLs).

## **Vector Surveillance and Integrated Vector Management (IVM)**

A regional assessment of entomological surveillance and control needs was completed, followed by the provision of TA on the development of national vector surveillance information systems in Brazil and Colombia. Countries performed data analysis with technical support from AMI partners, following country-level assessments of insecticide resistance monitoring and long-lasting insecticidal net (LLIN) efficacy and durability. National insecticide resistance management plans, such as one developed with Peru's National Institute of Health (INS), were designed with PAHO/WHO and CDC support.

## **Epidemiological Surveillance**

Improvements were made to national health information systems, including case notification at the decentralized level in Brazil, Guatemala, and other countries. PAHO/WHO mobilized a team to assess Guyana's national malaria surveillance system. This on-the-ground assessment informed the development of a regional data validation tool to be used in other countries. In accordance with WHO guidelines, individual case investigation was enhanced in a variety of countries; this included the incorporation of molecular diagnosis techniques such as polymerase chain reaction (PCR) into routine surveillance activities in select countries pursuing malaria elimination.

## **Networking and Systems Strengthening**

Annual AMI/RAVREDA evaluation and semi-annual Steering Committee meetings were held to share evidence and disseminate best practices among participating countries. Led by Brazil, epidemiological data sharing began amongst Guiana Shield countries with the purpose of addressing mobile populations in border regions. Panama

and Colombia, Honduras and Nicaragua, Peru and Brazil, and other pairs of countries coordinated surveillance and control activities along their shared borders. A regional antimalarial stock monitoring system was institutionalized, and transfers of antimalarial medicines among countries were made possible through facilitation by PAHO/WHO.

Since 2001, the use of the evidence base to make decisions about malaria policies and programs has become the norm across the region, and country-level capacity in technical areas supported through AMI has increased. This has largely been possible, thanks to an enhanced coordination and dissemination of operational research results. Further, in terms of coordination and systems strengthening, the design of national communication and advocacy strategies for malaria was completed in Brazil, Colombia, Ecuador, Guyana, Peru, and Suriname, and a regional communication strategy was also developed for the bloc of five Central American countries (Belize, Guatemala, Honduras, Nicaragua, Panama). Reactivation of Brazil's national-level education, communication, and social mobilization component for malaria occurred with AMI support in 2015, and the country officially joined with several others in the region in the pursuit of malaria elimination.

As of December 2015, after the region as a whole reached an estimated 67 percent reduction in morbidity compared to the year 2000 baseline, 14 countries in the LAC region had made a political commitment to eliminating malaria in the coming years.<sup>1</sup> Operational, technical, and financial factors will play a role in whether or not countries meet the WHO requirements to certify malaria elimination. Despite the region's substantial reductions in malaria cases, some countries (Guyana, Nicaragua, Panama, Peru and Venezuela) face challenges as they record an increase in the number of malaria cases. Nonetheless, the fact that the WHO's Global Malaria Program, the Bill and Melinda Gates Foundation, the Clinton Health Access Initiative (CHAI), and numerous countries have deemed malaria elimination in the Americas feasible is a testament to health system improvements in malaria surveillance and case management in the region.

Now that significant progress has been made to reduce local malaria transmission with improved access to diagnosis and treatment across large portions of the Americas, another of the remaining challenges is to extend the same consistent health services to key populations that experience heightened vulnerability to malaria. Key populations such as migrant workers and indigenous populations that experience higher incidence of malaria are not only socially marginalized, but also have significantly lower access to government health services in general.<sup>2</sup> In countries supported by AMI, the populations that are considered most vulnerable to malaria infection are itinerant miners, loggers, remote or mobile populations, pregnant women, and indigenous peoples, who are notoriously hard to reach. However, the stratified approach recommended in the WHO's *Global Technical Strategy* and the forthcoming *Strategy and Action Plan for Malaria in the Americas 2016–2020* indicate that new, targeted strategies will be needed to detect and treat new cases among these populations in order to meet the countries' ambitious elimination goals. AMI partners have begun to turn their attention to these key populations, but success depends on the strength of the region's health systems, the use of innovative approaches, and the assurance of long-term political commitment to end malaria in the Americas region.

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1 WHO. December 2015. *World Malaria Report 2015*. URL: <http://www.who.int/malaria/media/world-malaria-report-2015/en/>

2 Global Fund to Fight AIDS, Tuberculosis and Malaria. *Key Populations Action Plan 2014–2017*. URL: [http://www.theglobalfund.org/documents/publications/other/Publication\\_KeyPopulations\\_ActionPlan\\_en/](http://www.theglobalfund.org/documents/publications/other/Publication_KeyPopulations_ActionPlan_en/)

# MALARIA IN LATIN AMERICA AND THE CARIBBEAN

## Chapter I

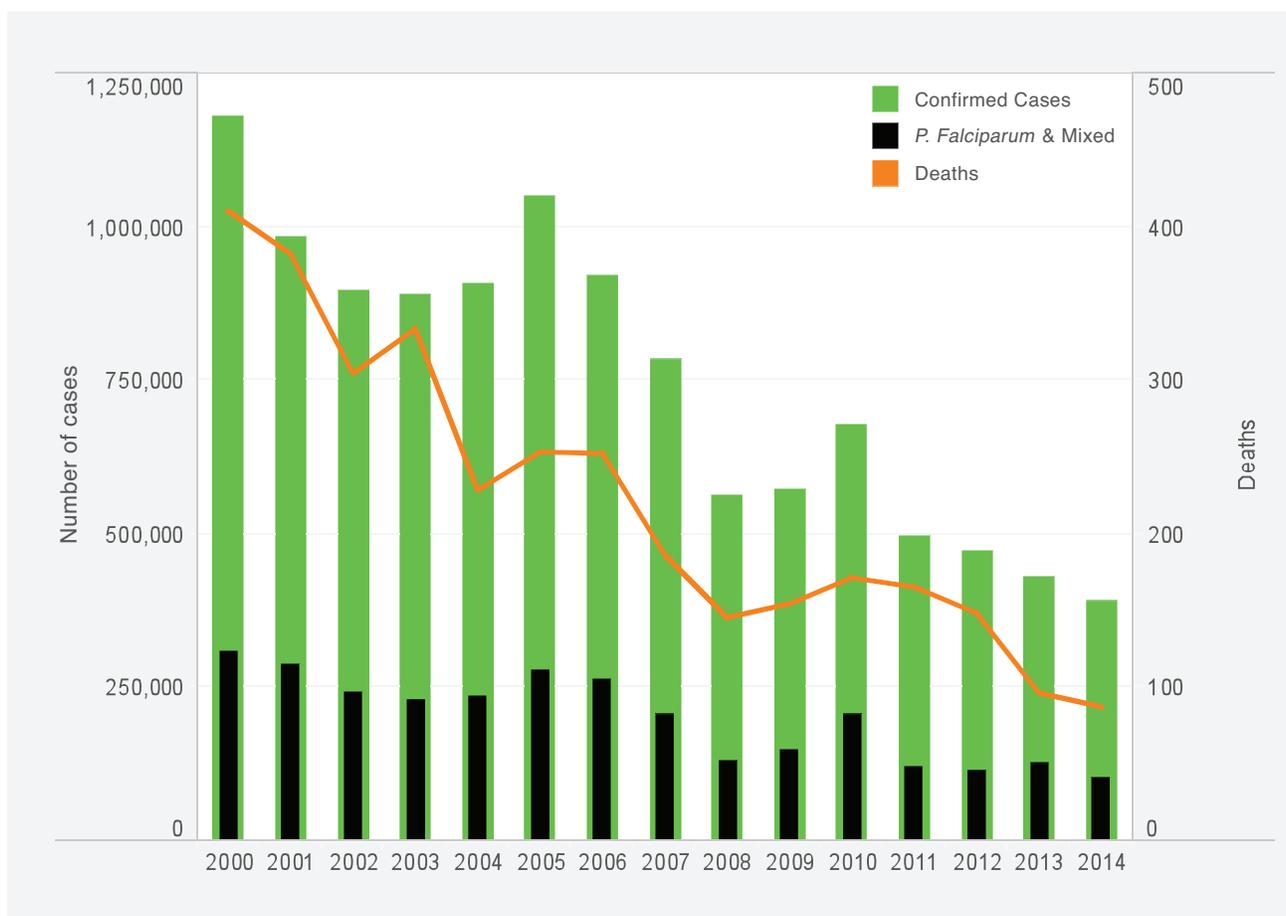


Photo: PAHO/WHO

# I.1 EPIDEMIOLOGICAL CONTEXT AND TRENDS

In 2014, malaria-endemic countries in the LAC region reported 390,000 confirmed malaria cases, a 67 percent reduction in cases since 2000. *Plasmodium vivax* infections accounted for nearly 69 percent of cases in endemic countries, *Plasmodium falciparum* and mixed infections accounted for 24 percent, and the share of *Plasmodium malariae* infections was only 0.1 percent (present in Brazil, Colombia, Costa Rica, French Guiana, Guyana, Peru, and Venezuela). Countries also reported 87 malaria deaths, which represented a 79 percent reduction in mortality since 2000.<sup>3</sup> Nineteen out of 21 endemic countries in the region recorded lower numbers of annual malaria cases during the same period, and only Venezuela and Haiti saw increased cases.<sup>4</sup> Many countries in the LAC region are on track to achieve international targets: 14 of the 21 endemic countries have reached the United Nations 2015 Millennium Development Goal 6 (MDG 6) of reducing malaria incidence by at least 75 percent compared to the year 2000 baseline.

**Figure I. Declining Malaria Burden in the LAC Region**

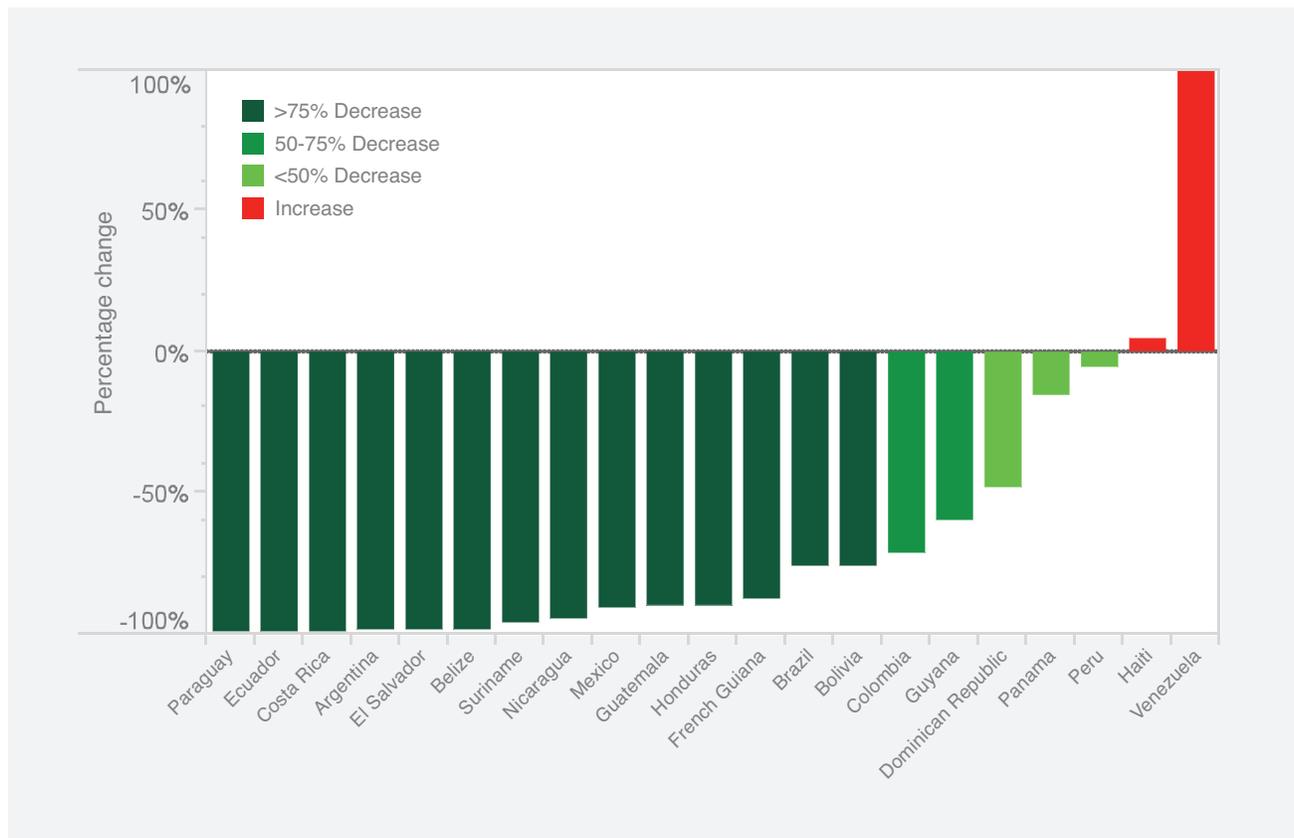


<sup>3</sup> Ibid I.

<sup>4</sup> Ibid I.

According to official country-level data reported to PAHO/WHO, Brazil remains the country with the most cases in the region, but had nearly 40 percent fewer cases in 2014 as compared to 2012. Bolivia, Mexico, Venezuela, Peru, and Panama were the only five countries that had an increase in malaria cases in 2014 compared to 2012; malaria has been increasing in Venezuela since 2009. In Peru, specifically in the Loreto Region, malaria nearly tripled between 2011 and 2014, with 60,566 reported cases in 2014.<sup>5</sup> Another 2,234 malaria cases imported from endemic countries were reported by 11 non-endemic countries in the LAC region in 2014. Argentina is pursuing malaria elimination and has formally requested that WHO commence the process to certify malaria elimination. Seven other countries are classified to be in the elimination and pre-elimination phase: Belize, Costa Rica, the Dominican Republic, El Salvador, Ecuador, Mexico, and Paraguay.

**Figure 2. Decrease in Malaria Morbidity in LAC Countries, 2000–2014**



Laboratory confirmation of diagnosis and prompt treatment remain the focus of malaria control in the LAC region. Microscopy remains the standard for diagnosing malaria in the region, with some countries using RDTs in remote areas. In all LAC countries, chloroquine (CQ) and primaquine (PQ) are used as the first-line treatment for *P. vivax*. For *P. falciparum*, seven countries in Central America, in addition to the Dominican Republic, Haiti, and Mexico rely on CQ as the first-line of treatment for *P. falciparum*, as they have no known resistance to this medicine. However, in South America, 11 countries rely on an artemisinin-based combination therapy (ACT) as the first-line of treatment for *P. falciparum*. The ACTs used are combinations of artemether + lumefantrine or artesunate + mefloquine, formulated as a fixed dose combination in all countries except Peru, where implementation of a fixed dose combination is pending.

<sup>5</sup> Peru's Ministry of Health. 2015. URL: <http://www.dge.gob.pe/portal/docs/vigilancia/sala/2015/SE01/malaria.pdf>

Countries use indoor residual spraying (IRS) of insecticide to kill the *Anopheles* mosquitoes that transmit malaria, but the share of the population that is protected by this measure varies from country to country. Compared to the previous year, in 2014 an increase was reported in the number of people protected by IRS in Colombia (519,000), Honduras (106,000), and Peru (107,000). IRS coverage decreased in Belize (21,000), Brazil (287,000), and Nicaragua (94,000). The number of people protected by insecticide-treated nets (ITNs) also varies from country to country. In 2014, a significant annual increase was reported in Brazil (884,000), Guyana (298,000), and Peru (68,000). A remarkable annual decrease in people protected by ITNs was reported in Colombia (741,000), Guatemala (994,000), and Suriname (6,000). In addition to a decrease in protection due to the normal wear and tear of ITNs, several countries did not distribute ITNs from 2011–2014.<sup>6</sup>

**Figure 3. IRS and LLIN/ITN Coverage**



Total financing available for malaria declined in 2014, including a decrease in external funding to the LAC region. Decentralization and shifts in funding at the national level have contributed to this, as have the emergence of competing priorities such as Dengue and Chikungunya. In addition, government budgets for malaria decreased in seven countries. This may reflect the success experienced as a result of malaria control efforts in the region, which is now composed of areas of moderate-to-low or low malaria transmission, as well as areas with no transmission but that remain at risk. Meanwhile, AMI partners are concerned with localized re-emergence (an increase in the number of cases as compared to previous years) and/or re-establishment of malaria transmission (cases begin to occur after a period with no cases). The observed rise in cases in countries such as Venezuela, Panama and Peru may pose a threat to neighboring countries due to population migration. Country programs will need to adapt and employ appropriate measures in response to the changing epidemiology of the disease in the region, especially as more countries transition towards elimination. Country-led efforts including the maintenance of quality of surveillance systems, along with the smooth transition from vertical to horizontal and top-down to decentralized malaria programs, will be vital to sustain the progress and avoid setbacks in the coming years.

<sup>6</sup> PAHO-USAID AWARD NO. 627-A-12-00006. 2016. Final Report. Amazon Malaria Initiative (AMI) and South American Infectious Diseases Initiatives (SAIDI) Components of the South America Regional Infectious Diseases Program (SARI).

## I.2 AMAZON MALARIA INITIATIVE

USAID launched AMI in 2001 to improve the prevention and control of malaria in partner nations of the Amazon basin. The initiative's mission is to: (1) ensure that national malaria control programs (NMCPs) in the Amazon basin and selected Central American countries substantially incorporate best practices, and (2) promote evidence-based policy changes in the partner countries. From inception, AMI has maintained a comprehensive view of malaria prevention and control. Its initial focus was to build the evidence base to support the introduction of ACTs for *P. falciparum* malaria in all Amazon basin countries, and to improve access to and quality of malaria diagnosis. As progress was made in introducing ACTs, areas such as epidemiological surveillance, vector control, and systems strengthening received further attention.

**Map I. AMI Partner Countries**



USAID established AMI as a collaborative partnership among organizations (the AMI implementing partners) that provide technical and scientific expertise and collaborate with the countries' MOHs and NMCPs grouped in the RAVREDA network to proactively address malaria prevention and control in a sustainable manner. Partner countries also collaborate with one another and maintain an ongoing exchange of information and expertise through South–South cooperation promoted and supported by AMI. Countries supported by AMI in FY 2015 included Belize, Brazil, Colombia, Ecuador, Guatemala, Guyana, Honduras, Nicaragua, Panama, Peru, and Suriname.

Countries optimize their approaches through shared TA provided by AMI implementing partners, through the development of standardized guidelines and research protocols allowing the comparability of research and monitoring results within and across countries, and through the development of coordinated approaches to address shared problems.

Six technical areas of intervention are carried out by AMI implementing partners, with transversal support in communication focusing on advocacy, outreach, and information dissemination:

1. Monitoring of efficacy and resistance to antimalarials, and prevention of the emergence of resistance to antimalarials;
2. Access to quality diagnosis and treatment;
3. Quality assurance and control of pharmaceuticals and other supplies for malaria prevention and control;
4. Vector surveillance and IVM;
5. Epidemiological surveillance; and,
6. Networking and systems strengthening.

With a regional five-year strategy and plan of action as their guide, countries coordinate work plans and budgets for priority activities. Through South–South collaboration within the LAC region, AMI-supported countries share best practices, learn from other country experiences in the region, leverage technical and financial resources for TA, and are better able to coordinate their malaria control programs with their neighbors.

Through TA from implementing partners, AMI seeks to ensure that NMCPs adaptively respond to the local malaria context with differentiated strategies for moderate and low-transmission areas, as well as for key populations at greater risk of malaria infection due to remoteness, population mobility, or social marginalization. Additionally, AMI helps to coordinate technical interventions to monitor medicine efficacy and to prepare to respond to the emergence of antimalarial resistance, particularly artemisinin derivatives. Participating countries receive support to address the risk of malaria reemergence and reintroduction. All in all, countries benefit from AMI/RAVREDA by strengthening their capacity to select, implement, monitor, and evaluate malaria prevention and control interventions in a sustained manner.

Considering that AMI represented an investment of only \$3.5 million from USAID in FY 2015, AMI/RAVREDA has resulted in a cost-effective, coordinated regional approach to malaria prevention and control. Strategic coordination and integration of implementing partners through the AMI Steering Committee have led to a far greater impact than the project budget would suggest, informing the decisions made around significant national-level budgets and leveraging funds from international donors in LAC.

## **Monitoring AMI's Progress**

AMI's Strategic Objective is to assist malaria control programs in the Amazon basin and Central America to substantially incorporate selected best practices. AMI partners work to ensure that countries can effectively and efficiently address malaria through evidence-based activities, adoption and sharing of best practices, and collaboration through a regional network.

Primary impact indicators are: (1) the number of confirmed malaria cases in each country, and (2) the number of malaria deaths each year. Progress since 2001 is detailed below, in Table 1.

**Table I. Changes in Malaria Morbidity and Mortality in AMI Partner Countries<sup>7</sup>**

Country	Confirmed Cases			Deaths		
	2001	2014	Change %	2001	2014	Change %
Belize	1,162	19	-98.36%	0	0	0.00%
Brazil	388,303	143,145	-63.13%	142	36	-74.64%
Colombia	231,233	40,768	-82.36%	58	17	-70.68%
Ecuador	108,903	241	-99.77%	16	1	-93.75%
Guatemala	35,824	4,931	-86.23%	0	1	100.00%
Guyana	27,122	12,353	-54.45%	30	11	-63.33%
Honduras	24,149	3,380	-86.00%	0	2	200.00%
Nicaragua	10,482	1,163	-88.90%	2	0	-200.00%
Panama	928	874	-5.81%	1	0	-100.00%
Peru	78,544	64,676	-17.65%	25	3	-88.00%
Suriname	16,003	401	-97.49%	23	0	-100.00%
<b>Totals</b>	<b>922,653</b>	<b>271,951</b>	<b>-70.52%</b>	<b>297</b>	<b>71</b>	<b>-76.09%</b>

\*All countries started receiving AMI support in 2002, with the exception of Belize, Guatemala, Honduras, Nicaragua, and Panama, which began receiving AMI support in late 2007.

Between 2001 and 2014, malaria morbidity decreased by 71 percent overall in AMI-supported countries, and mortality decreased by 76 percent. Nonetheless, progress has not been evenly spread across all countries. For instance, annual malaria cases in Peru have increased steadily since reaching their lowest point in 2011, reaching 64,676 confirmed malaria cases in 2014, which amounts to a decrease of only 5 percent since the year 2000. Although malaria-related deaths fell by 80 percent from 2000 to 2014, Peru is no longer on track to meet the MDG 6 targets for malaria morbidity.

The Initiative's intermediate results (IRs) are:

- IR 1** — Evidence base for malaria prevention and control increased
- IR 2** — Evidence base for malaria prevention and control communicated and used
- IR 3** — More inclusive and better informed policy process promoted for malaria prevention and control

In terms of expected results, AMI has sought to achieve: (1) more reliable and standardized surveillance information on malaria drug resistance and vector control used to monitor trends and more effectively target disease control efforts; (2) laboratory diagnosis of malaria improved; and (3) tools and approaches developed, adapted, tested in local settings, and disseminated.

For performance management purposes, each technical and country partner has a unique set of objectives, milestones, outcomes, and indicators related to progress made in the program's six technical areas. PAHO/WHO's reported outcomes and indicators for each line of work follow below.

- **Proportion of Amazon countries that have an updated, evidence-based strategy for monitoring the efficacy of and resistance to antimalarials that consider different epidemiological situations**

Baseline: 11/11

Final: 11/11

<sup>7</sup> Ibid 6.

- **Proportion of AMI countries on track to achieving reduction of malaria morbidity by 75%, as compared to the baseline year 2000**  
 Baseline: 10/11  
 Final: 9/11
- **Proportion of AMI countries that adopt and implement strategies for maintaining capacities to diagnose and treat malaria, considering different epidemiological scenarios**  
 Baseline: 11/11  
 Final: 11/11
- **Proportion of AMI countries that adopt and implement a strategy to assure and control quality of antimalarials, considering different epidemiological scenarios**  
 Baseline: 11/11  
 Final: 11/11
- **Proportion of AMI countries that adopt and implement a vector surveillance strategy to ensure availability of malaria vector information, considering different epidemiological scenarios**  
 Baseline: 10/11  
 Final: 11/11
- **Proportion of AMI countries that adopt and implement a vector surveillance strategy to ensure availability of malaria vector information, considering different epidemiological scenarios**  
 Baseline: 10/11  
 Final: 11/11
- **Proportion of AMI countries that adopt and implement a vector control strategy based on IVM, considering different epidemiological scenarios**  
 Baseline: 8/11  
 Final: 10/11
- **Proportion of countries that adopt and implement an epidemiological surveillance strategy to ensure availability of malaria epidemiological surveillance information and its integration or articulation with vector surveillance and control and monitoring and evaluation of other malaria control activities considering different epidemiological scenarios**  
 Baseline: 11/11  
 Final: 11/11
- **Proportion of countries that report malaria based on individual records (data disaggregated by sex, age, ethnicity, and other variables that facilitate appropriate analysis)**  
 Baseline: 11/11  
 Final: 11/11
- **RAVREDA countries promote and support activities through national financing**  
 Baseline: 11/11  
 Final: 11/11

- **RAVREDA countries adopt and support implementation of tools (e.g. communication and others) for strengthening effective and efficient malaria prevention and control activities in the Amazon region and Central America**

Baseline: 11/11

Final: 11/11

- **Countries adopt and implement plans for improving national malaria control program's effectiveness and efficiency in a decentralized health sector**

Baseline: 11/11

Final: 11/11



Photo: PAHO/WHO

## I.3 OTHER REGIONAL INITIATIVES

AMI/RAVREDA seeks to improve stakeholder coordination in the region and avoid duplication of efforts in order to make a complementary contribution to the shared goal of reducing morbidity and mortality due to malaria. Independent country activities are coordinated through PAHO and RAVREDA. Regionally, AMI has championed the implementation of PAHO's *Strategy and Plan of Action for Malaria in the Americas for 2011–2015*,<sup>8</sup> and during the first quarter of FY 2016 USAID provided support for the development of a forthcoming *Strategy and Plan of Action for Malaria 2016–2020*. The new strategy will focus on characteristics unique to the evolving malaria context in the Americas, in alignment with the WHO's *Global Malaria Technical Strategy (GTS)* and *Action and Investment to Defeat Malaria (AIM) 2016–2030*.

Besides national budgets, the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) is one of the largest external funding sources in the region. In 2013, GFATM committed \$10.2 million to the regional Malaria Elimination Initiative for Central America and Hispaniola (EMMIE) using a cash-on-delivery approach to catalyze progress towards malaria elimination. Ten MOHs in the Central America sub-region, the Dominican Republic, and Haiti, together with bilateral and multilateral agencies, research centers, and other partners, embarked on an effort to achieve no local transmission of malaria by 2020 and seek certification of malaria elimination by 2025. Among the 11 countries that are supported by AMI, during the 2015 and 2016 fiscal years, GFATM provided country-specific malaria grants in Guatemala, Honduras, Nicaragua, Suriname, and Guyana.

GFATM has shared information, tools, and approaches generated with support from AMI implementing partners in the preparation and execution of their GFATM projects. AMI/RAVREDA has provided technical advising to NMCPs to promote national institutionalization of these approaches and sustainability of gains achieved through GFATM support.

A Regional Coordinating Mechanism (MCR, by its Spanish acronym) for Central America and Hispaniola, which is formally responsible for integrating technical efforts for the implementation of EMMIE, supported the creation of a Regional Civil Society League for Malaria in February 2015. The Regional Civil Society League aims to support advocacy, improved collaboration, increased outreach to remote communities where transmission persists, enlistment of behavior change expertise, and mobilization of additional resources to increase and sustain the activities for prevention and elimination of malaria. AMI partner Links Media joined the league in the fourth quarter of FY 2015 in order to collaborate with the league's partners and members.

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8 PAHO. 2011. 51st Directing Council - 63rd Session of the Regional Committee. *Strategy and Plan of Action for Malaria*. URL: [http://www.paho.org/hq/index.php?option=com\\_docman&task=doc\\_view&gid=15005&Itemid](http://www.paho.org/hq/index.php?option=com_docman&task=doc_view&gid=15005&Itemid)

**Table 2. Other Organizations and Initiatives Active in Malaria Control or Elimination in the Americas Region**

**Malaria Zero – The Alliance for a Malaria-Free Haiti**

Malaria Zero is an alliance of partners that have united to eliminate local transmission of malaria on the island of Hispaniola by 2020. The consortium was launched in February 2015, with a \$29.9 million grant from the Bill & Melinda Gates Foundation. During FY 2015, as part of an effort to help AMI coordinate with other initiatives in the region, PAHO/WHO collaborated with USAID, the CDC, and Links Media to develop a malaria elimination training curriculum to assist Haiti’s National NMCP reorient and move beyond routine control activities.

**Clinton Health Access Initiative (CHAI)**

CHAI works in partnership with governments to help strengthen malaria programs, reduce the burden of disease, and accelerate progress toward sustainable malaria elimination. As of 2014, CHAI has been working to develop multi-sectoral partnerships in Guatemala, Honduras, Panama, Costa Rica, and Hispaniola. CHAI is currently exploring possible collaboration with private corporations, such as cell phone companies, agribusiness in Guatemala and Honduras, and the beverage industry in Haiti. In Guatemala, CHAI forged a relationship between the malaria program and the National Sugar Cane Association (ASAZGUA, by its Spanish acronym). This partnership led to ASAZGUA’s participation in the National Strategic Plan for Malaria Elimination 2015-2020 consultation held in October 2014. Additional activities are in development.

**Mesoamerican Initiative on Malaria in Vulnerable Populations**

The Mesoamerican Initiative works to improve malaria control with the goal of elimination in the following countries: Belize, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, and the Dominican Republic. Its purpose is to guide the countries of the sub-region towards pre-elimination and subsequent elimination of the disease, giving special consideration to vulnerable populations (defined as indigenous, Afro-descendant, mobile populations, plantation workers, and day laborers, among others).

**UCSF Global Health Group’s Malaria Elimination Initiative (MEI)**

The University of California San Francisco (UCSF)’s MEI works with partner organizations at the global, regional, and national levels to develop new tools and advocate for greater attention and international support for malaria-eliminating countries.

**International Centers of Excellence for Malaria Research (ICEMR)**

In 2010, the U.S. National Institutes of Health established ICEMR in seven major geographic regions where malaria is endemic. Latin America has two ICEMRs, the Latin American Center for Malaria Research and Control (Guatemala, Panama, Colombia, and Peru) and the Peruvian/Brazilian Amazon Center of Excellence in Malaria (Peru and Brazil). AMI’s coordination with the Latin American Center for Malaria Research and Control aims to strengthen operational research and further contribute to malaria elimination in the region.

**Naval Medical Research Unit 6 (NAMRU-6)**

The US NAMRU-6 conducts surveillance and research on malaria and other infectious diseases that are of military or public health significance in the region. AMI implementing partners have worked with NAMRU-6 on the publication and dissemination of research findings on molecular epidemiology in Peru.

# TECHNICAL AREAS

## Chapter 2



Photo: Jorge Escobedo/Peru's MOH

## 2.1 DIAGNOSIS

Laboratory diagnosis of malaria through microscopy remains the regional standard for confirming malaria cases. One of AMI's priorities has been to strengthen and maintain the existing network for microscopic diagnosis that exists in LAC and improve laboratory diagnosis in *all* epidemiological settings. PAHO/WHO and other partners have evaluated the quality of malaria supplies including rapid diagnostic testing products and materials used for the preparation of blood slides. AMI has also worked with countries to maintain proper distribution and good storage practices in order to uphold the quality of supplies for malaria. From October 2014 to February 2016, AMI partners strengthened and expanded the region's diagnostic capacity related to malaria and introduced RDTs in Honduras and Guyana in order to meet the need for prompt diagnosis in hard-to-reach areas where microscopy has been unavailable. By and large, AMI has made significant contributions to improving the ability of health systems to guarantee that populations have access to early, quality malaria diagnosis, no matter the epidemiological context. During FY 2015 alone, USAID support through AMI enabled the training of 599 people on malaria diagnosis, including 342 female and 257 male training participants.

### Microscopy Diagnosis

With decreasing malaria cases, countries need to prioritize the quality of diagnosis in order to detect each and every case. Maintaining high performance standards for microscopists helps to ensure accurate malaria surveillance and evidence-based control measures. With malaria cases becoming less frequent in many countries, laboratory staff have fewer opportunities to practice their microscopy skills for reading thick blood slides and thin film. The NMCP in Peru addressed this challenge in FY 2015 by developing the diagnostic capacity of an additional 33 microscopists to perform malaria diagnosis. Brazil's NMCP has also been working to maintain the capacity of its 4,900 microscopists in all areas of the country who collectively carry out two million malaria tests each year.<sup>9</sup>

Peru and Honduras' national laboratories lead the way in maintaining the existing network of national laboratory facilities in the LAC region. The laboratories participate in the global external evaluation for malaria diagnosis that is coordinated by the WHO regional office for Africa (EQAP/WHO/AFRO). Honduras' national laboratory took on the task of creating a regional slide bank with 1,066 sample slides of *P. falciparum* and *P. vivax* malaria by the end of FY 2015. All samples were tested using PCR prior to their inclusion in the slide bank, following standard operating procedures (SOPs) adapted from WHO's South East Asia Regional Office (WHO/SEARO) and with assistance from PAHO. Other malaria-endemic and non-endemic countries in the region will be able to borrow panels from Honduras' slide bank to sustain their national diagnostic capacity for malaria through trainings and periodic evaluations following quality assurance procedures.

In 2011, PAHO's Regional Malaria Program established an EQAP to improve the quality of malaria diagnosis across countries. The evaluation program serves to standardize microscopy processes and protocols regionally. The National Malaria Reference Laboratories of Honduras and Peru, in their role as supranational reference laboratories, prepare standardized panels of slides for distribution to participating laboratories in other countries.

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<sup>9</sup> Santelli, Ana Carolina Faria e Silva. 2015. Avanços e Desafios: Controle de Malária no Brasil. Apresentação à XIV Reunião Anual de Avaliação da AMI/RAVREDA em 24 de março de 2015. Rio de Janeiro, Brasil: Coordenação Geral do Programa Nacional de Controle da Malária DEVIT/SVS/Ministério da Saúde – Brasil.

Four rounds of evaluation were undertaken from 2011 to 2015, with 21 national reference laboratories from 20 different LAC countries participating in the fourth round during FY 2015.

From May 11–22, 2015, PAHO carried out a second regional training workshop and certification of South American microscopists, following on the first such workshop that had been conducted with laboratory staff from Central American and Caribbean countries in 2014. Facilitators from PAHO, along trainers from Mexico, Honduras, and Peru strengthened the regional capacity for malaria microscopy diagnosis by certifying 19 staff from Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Suriname, and Venezuela in diagnostic techniques. The training was tailor-made to address knowledge and skill gaps specific to the South American countries. Participants were trained in the theoretical processes and practical skills needed for microscopy diagnosis and quality assurance, in accordance with PAHO/WHO guidelines to strengthen diagnostic quality assurance/quality control (QA/QC) for malaria. Although Mexico does not receive support from AMI, the Mexico's MOH played a key role in collaborating with the PAHO/Mexico office to make the 2015 regional microscopy workshop a reality.

In order to disseminate conclusions about the quality of malaria microscopy diagnosis in the region, PAHO presented a poster with the EQAP results at the 64th American Society of Tropical Medicine and Hygiene (ASTMH) Annual Meeting from October 25–29, 2015.<sup>10</sup> Compared with previous rounds, microscopy performance in 2015 showed a satisfactory improvement and achievement of a high concordance percentage for diagnosis and parasite morphology. However, parasite density estimation and species identification still needed reinforcement. Given different treatment regimens for *P. falciparum* and *P. vivax* throughout the Americas, AMI partners have recommended that countries focus on species identification and parasite density estimation in order to move towards malaria elimination.

A further expansion of the EQAP in its role of strengthening diagnosis quality assurance processes in the region is likely, given that French Guiana and Puerto Rico have requested to be involved in the upcoming fifth round. Whereas the 2015 workshop for 23 participants from nine South American countries was hosted at Mexico's Institute of Epidemiological Diagnosis and Reference (InDRE), EQAP exemplifies the sort of sustainable regional collaboration that AMI/RAVREDA fosters.

## Rapid Diagnostic Tests

RDTs for malaria can be important point-of-care tools because they are simple to use and easy to transport. RDTs are recommended in special circumstances in the LAC region. Following PAHO/WHO and CDC guidelines, RDTs are only used in AMI-supported countries when laboratory diagnosis with microscopy is not possible, such for diagnosing malaria in remote, indigenous, and mobile or migrant populations.

Remote and mobile populations are an important source of new malaria infections in many LAC countries. For example, Honduras' difficult to reach malaria-endemic region of La Mosquitia shares a border with Nicaragua, where the predominantly Miskito indigenous population moves between the two countries on a daily basis, making it difficult to provide timely microscopy diagnosis. For that reason, in FY 2015 Honduras' NMCP launched RDT use by community health workers in La Mosquitia. With PAHO/WHO and Links Media's support, Guyana's NMCP also began an RDT field validation to test the clinical sensitivity and prepare for the use of RDTs with mobile populations in Region 8 during the first quarter of FY 2016. During the RDT launch that

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<sup>10</sup> Results are available at: [http://www.paho.org/hq/index.php?option=com\\_topics&view=readall&cid=5525&Itemid=40757&lang=en](http://www.paho.org/hq/index.php?option=com_topics&view=readall&cid=5525&Itemid=40757&lang=en)

began in November 2015, PAHO/WHO also provided training on the preparation of thick smear blood slides to confirm the results of each RDT administered, through microscopy. In preparation for RDT selection, MOHs such as that of Guyana have obtained updated evaluations of RDT cost, sensitivity, and specificity through PAHO/WHO.

Rather than detecting malaria parasites, RDTs work by detecting specific antigens derived from parasites, whether HRP2, lactate dehydrogenase (pLDH), or aldolase enzyme. The majority of commercial RDTs used in the region are based on the detection of *P. falciparum* histidine-rich protein 2 (PfHRP2), but as researchers from Peru reported in 2010 that the deletion of the gene encoding HRP2 was frequent among natural *P. falciparum* parasite populations can lead to false negative test results,<sup>11</sup> several countries undertook molecular analysis to survey the deletion of HRP2 and histidine-rich protein 3 (HRP3) genes in parasites collected in six South American countries between 2009 and 2012, with AMI support (see Table 3 with current “cumulative” data on HRP2 and HRP3<sup>12</sup> deletion per country). Five countries found evidence of HRP2 gene deletion in *P. falciparum* isolates. Preliminary results showed gene deletion in Peru, Brazil, Bolivia, Colombia, and Suriname. Gene deletion was frequent in various parts of Peru, while it was found in high proportions only in some regions of Brazil and Colombia. Guyana was the only country assessed that did not show deletion of HRP2 and HRP3.

11 Gamboa D, Ho M-F, Bendezu J et al. 2010. A Large Proportion of *P. falciparum* Isolates in the Amazon Region of Peru Lack *pfhrp2* and *pfhrp3*: Implications for Malaria Rapid Diagnostic Tests. *PLoS ONE*. 5(1): e8091.

12 XII AMI/RAVREDA Meeting Report, Lima, Peru, April 9–12, 2013



Photo: PAHO/WHO

**Table 3: Current Data on HRP2 and HRP3 Gene Deletion per Country**

Country	HRP2 deletion (%)	HRP3 deletion (%)
Brazil	27/198 (13.6) <sup>13</sup>	71/198 (35.8) <sup>13</sup>
Colombia	18/100 (18) <sup>14</sup>	52/100 (52) <sup>14</sup>
Guyana	0/97 (0) <sup>15</sup>	0/97 (0) <sup>15</sup>
Honduras	0/68 (0) <sup>16</sup>	50/68 (73.5) <sup>16</sup>
Peru	31/93 (33.3%) <sup>17</sup>	50/93 (53.8) <sup>17</sup>
Suriname	11/78 (14) <sup>18</sup>	3/78 (4) <sup>18</sup>

\*Numbers collected from a variety of technical studies.

The results of the AMI supported regional assessment of the frequency of HRP2 and HRP3 deletion, has allowed for the publication of several articles in scientific journals in 2015.

Guyana and Suriname’s NMCPs, working in conjunction with local scientists and researchers from the CDC’s Malaria Branch, published in the May 2015 issue of *PLOS ONE*: “Variation in PfHRP2 and PfHRP3 Gene Deletions in Guyana and Suriname.” In this article, authors reported no PfHRP2 or PfHRP3 deletion was found in Guyana or among samples collected in Suriname between 2009 and 2010, but that PfHRP2 was detected in samples collected in Suriname in 2011. The latter provides additional basis to implement the monitoring of the prevalence of HRP2 gene deletion at regular intervals.

Honduras’ NMCP, in collaboration with CDC, PAHO/WHO, and local researchers, published an article on the “Prevalence of PfHRP2 and PfHRP3 gene deletions in Puerto Lempira, Honduras” in *Malaria Journal* in January 2015. Findings showed that no PfHRP2 gene deletion existed in samples collected during 2008–2009. Nevertheless, considering its frequent deletion reported elsewhere in the Amazon region, the authors considered useful to monitor for it.

National laboratory personnel in LAC countries have benefited from CDC training on the use of molecular analysis techniques and the CDC’s validation of country-level analyses. Numerous countries have the technical capacity to carry out molecular analysis in national laboratories, as was the case in Brazil, Honduras, and Suriname. However, increased logistical planning and dedication of national resources to collect and store parasite samples at regular intervals will be necessary in order for molecular analysis to become more widely used. NMCPs are responsible for ensuring that parasite samples are collected regularly.

13 Udhayakumar V. 2014. Revised Protocol and Follow-up Actions to Monitor the HRP2 Gene Deletion in the Region. Presentation. Managua, Nicaragua.

14 Murillo, SC et al. 2015. Deletion of *Plasmodium falciparum* Histidine-Rich Protein 2 (pfrp2) and Histidine-Rich Protein 3 (pfrp3) Genes in Colombian Parasites. *PLoS ONE*. 2015 Jul 7;10(7):e0131576.

15 Akinyi Okoth, S et al. 2015. Variation in *Plasmodium falciparum* Histidine-Rich Protein 2 (Pfrp2) and *Plasmodium falciparum* Histidine-Rich Protein 3 (Pfrp3) Gene Deletions in Guyana and Suriname. *PLoS ONE*. 10(5).

16 Abdallah, JF et al. 2015. Prevalence of pfrp2 and pfrp3 gene deletions in Puerto Lempira, Honduras. *Malaria Journal*. 14(19).

17 Akinyi, S et al. 2013. Multiple Genetic Origins of Histidine-Rich Protein 2 Gene Deletion in *Plasmodium falciparum* Parasites from Peru. *Scientific Reports*. Sep 30;3:2797.

18 Ibid 15.

## Molecular Surveillance and Case Investigation in Malaria Elimination/Post-Elimination Scenarios

Molecular markers can help to tell a more detailed story about how malaria outbreaks occur. They are useful for targeting responses to outbreaks, and they become essential in elimination and post-elimination scenarios. The level of precision achieved by diagnosing cases with molecular methods such as PCR exceeds that of traditional epidemiological methods; the tests are much more sensitive to parasite presence in the blood. Molecular tools such as microsatellites and genetic sequencing make it possible to distinguish between re-infections and relapses of *P. vivax* malaria in patients, which is important given that *P. vivax* accounts for the majority of malaria infections in LAC countries.

NMCPs can use molecular amplification methods for mass blood surveys aimed at mapping the prevalence of malaria, including submicroscopic infections, as well as to increase the power of surveys in low-transmission contexts. Some evidence shows that detecting and targeting asymptomatic malaria infections may be key to eliminating the disease from a defined geographic area. Rapid, accurate detection and treatment of infected individuals can prevent outbreaks from spreading and can help avoid the re-establishment of malaria in areas that have achieved zero incidence.

### Introducing Innovative Diagnostic Tools based on Molecular Methods

Improved technologies for conducting PCR include Loop-Mediated Isothermal Amplification (also known as the LAMP method) and the RealAmp kit that has been developed by the CDC as a portable and simple-to-use piece of field equipment. From 2014–2015, the Brazil's MOH and the Evandro Chagas Institute began validating RealAmp with training and supervision from the CDC. One thousand samples were collected from patients presenting with febrile illness by the end of 2015. RealAmp has been used for the laboratory processing of the samples in Brazil's Acre and Pará states. The CDC will provide quality control testing.

## Highlights

- Honduras created a malaria slide bank for use in microscopy trainings and research across the region.
- South American countries received training in proper malaria diagnosis and quality assurance processes in Mexico.
- Peru reinforced microscopists' capacity to perform malaria diagnosis in all areas of the country, with special emphasis on the Loreto Region where disease incidence is highest.
- Researchers from AMI supported countries and CDC published articles based on information produced through a regional survey of the prevalence of PfHRP2/HRP3 gene deletion in malaria parasite populations in the Americas.
- Countries received PAHO/WHO technical support on the selection and use of RDTs for malaria, according to data provided by WHO reports on RDT performance.
- Honduras implemented and evaluated RDTs in the remote, malaria-endemic area of La Mosquitia.
- Guyana prepared for the roll-out of RDTs in Region 8, in order to extend diagnostic capacity to areas where microscopy is not available.

## Implementation Challenges

The laboratory networks at the national and supranational levels need to be preserved in the LAC region in order to ensure capacity strengthening, quality assurance, and access to quality microscopy and RDT diagnosis. What is more, the maintenance of laboratory networks supports LAC countries' ability to conduct routine surveillance, monitor antimalarial efficacy, track antimalarial resistance, and build knowledge on parasite ecology. Unfortunately, after the conclusion of a successful five-year GFATM project in Colombia in 2015, laboratory capacity at the sub-national level began to decline in at least one malaria-endemic department. As a result, the country's ability to detect and treat all malaria cases may have been compromised. Colombia will need to do more to further institutionalize quality-assured diagnosis using microscopy at the decentralized level; the Colombia's Ministry of Health and Social Protection (MSPS, by its Spanish acronym) requires the buy-in of governors and mayors to ensure that malaria diagnostic capacity is made a priority within local health structures.

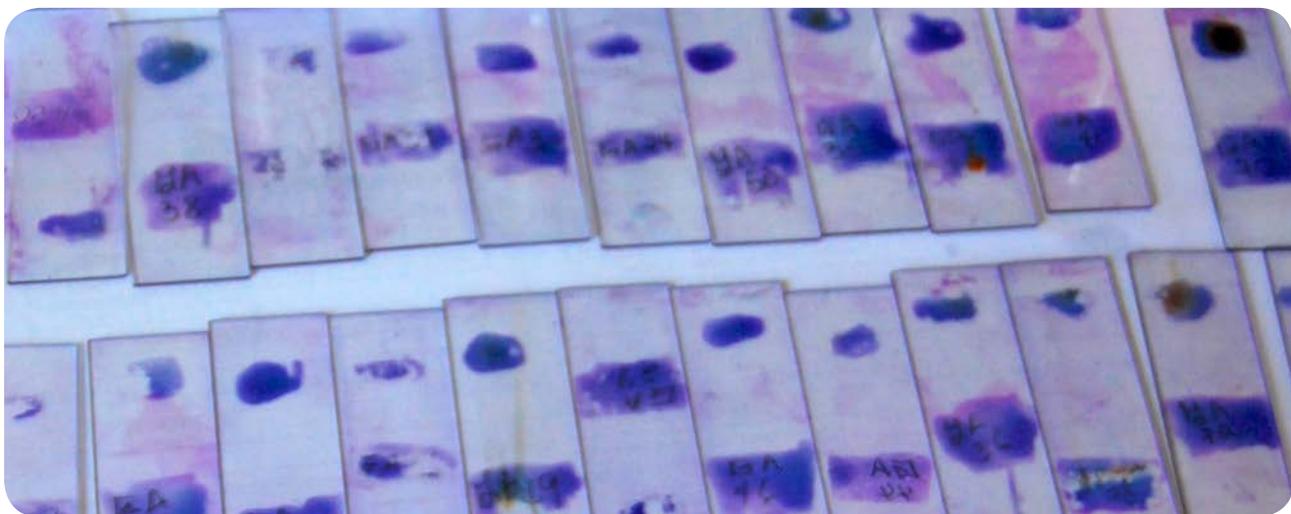
The need to maintain the capacity to diagnose and manage malaria cases in those territories with very low to no incidence remains as surveillance systems rely on case detection and treatment in order to respond rapidly to malaria re-emergence or re-introduction. Moving forward, innovative strategies need to be devised and implemented to ensure diagnostic capacity in these areas. Unfortunately, securing the resources needed to refresh or to strengthen microscopists' skills for malaria diagnosis has been difficult in light of competing health priorities such as outbreaks of Dengue, Chikungunya, and Zika.

Delivering primary health care to dispersed and /or remote populations is an ongoing challenge in the LAC region. Malaria RDTs are an attractive option to serve such populations for whom coverage with quality microscopy is low. However, factors such as the sensitivity, cost, and adequate performance of RDTs under difficult operational conditions may limit their use and scale-up.

Molecular tools such as PCR, microsatellites, and genetic sequencing are useful, but investing in them could divert resources away from more essential malaria prevention, diagnosis, and treatment services because of their high cost. This is a concern in countries with regions that still have a significant amount of active disease transmission.

There is a need for improved strategies to make the best use of microscopy and RDTs, and for making more sensitive tools available for routine use in the diagnosis of malaria infection.

Photo: PAHO/WHO



## 2.2 TREATMENT

### 2.2.a Pharmaceutical Supply Chain Management

Improving access to lifesaving antimalarial medicines and essential commodities in the LAC region is one of the key interventions supported through AMI. Countries' antimalarial procurement and distribution systems have been strengthened by PAHO's Regional Malaria Program, Essential Medicines Program, and Strategic Fund unit, along with the USAID-funded Systems for Improved Access to Pharmaceuticals and Services (SIAPS) program. Critical deficiencies in countries' pharmaceutical supply chains have been corrected with support from AMI implementing partners in order to meet regional, national, and local needs for antimalarial medicines and supplies. AMI partners work with MOHs in the region to: 1) monitor and report on antimalarial medicine stocks, 2) plan and manage antimalarials supplied for serving low incidence and at risk areas, 3) jointly procure essential medicines and supplies, 4) maintain a strategic regional stock of antimalarials to be provided in response to countries' special needs, 5) facilitate requests and donations of medicines among participating countries, 6) improve the management of central and decentralized medicines warehouses, and 7) develop strategies for access to malaria diagnosis and treatment for key populations.

While challenges remain in the LAC region, antimalarial stock availability improved from 57% to 85% in countries' central warehouses between 2010 and 2014,<sup>19</sup> it is unclear if AMI support has also improved medicine availability throughout the entire supply chain, since the countries participating in regional reporting do not include information at the health facilities level. However, it is assumed that countries are better prepared to supply medicines to all regions of the country once antimalarials are available in the national and sub-national levels (i.e. region, department or state).

#### Regional Inventory Monitoring and Reporting

In FY 2015, countries continued to monitor and report on stock levels of antimalarial medicines via the Regional Platform on Access and Innovation for Health Technologies (PRAIS, by its Spanish acronym), with support from PAHO's Strategic Fund unit and the MSH/SIAPS program. The PRAIS e-platform, which serves as a virtual reporting and information hub, enables MOH staff in LAC countries to share and retrieve information about medicines. On a quarterly basis, countries submit inventory data for dissemination via a *Regional Bulletin for the Availability of Antimalarial Medicines*, which has become a valuable monitoring tool to help prevent stock-outs and enable medicines to be exchanged between countries. The quarterly bulletin has given the NMCPs and PAHO/WHO immediate decision-making information, helped identify problems, and enabled medicines to be redistributed within the region. Eight to ten countries reported antimalarial stock data in each quarter of FY 2015. Analysis showed that the availability of antimalarials in central warehouses fluctuated around 85% between quarter one of FY15 and quarter one of FY16.

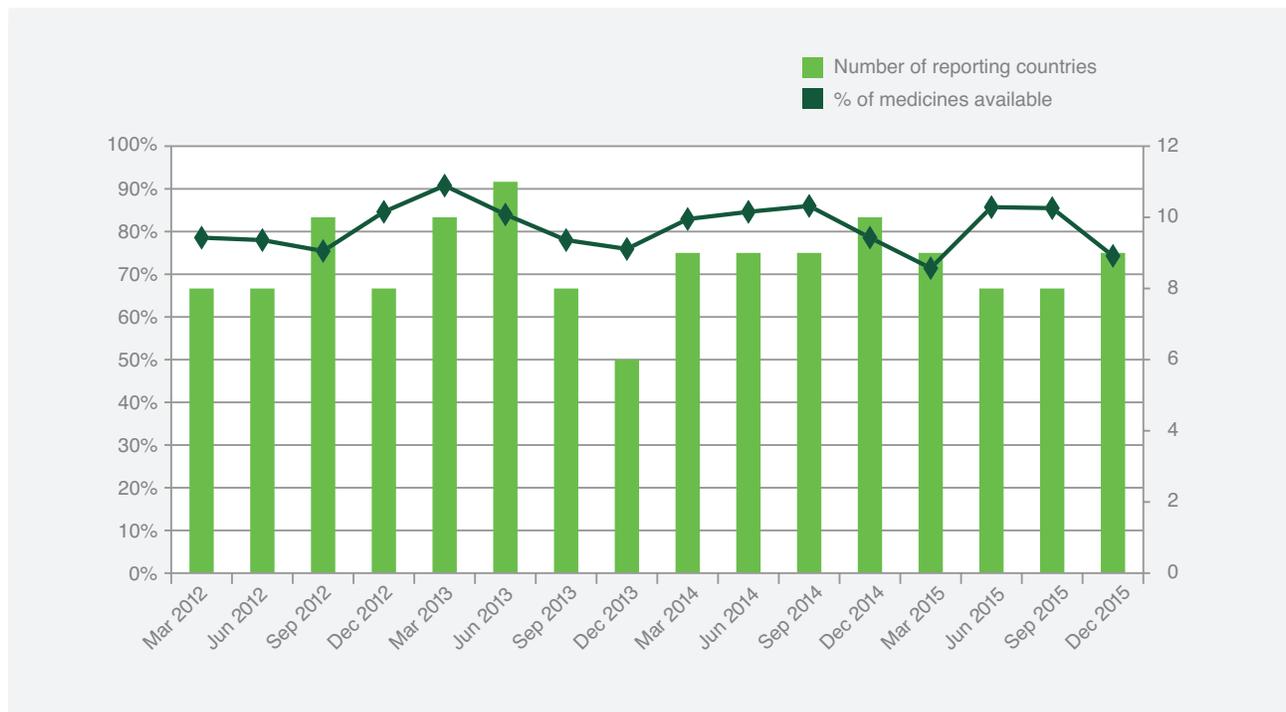
Country data on the consumption of antimalarials was added to the bulletin in FY 2015, given the fact that some discrepancies had occurred between the variations in antimalarial stocks and numbers of confirmed malaria cases

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<sup>19</sup> Marmion, J., Barillas, E., Echalar, R., de Carvalho, J., and Sánchez, M. (2014, November). *How low can we go? Lessons from an integrated partnership for malaria control*. Poster presented at the 63rd Annual Meeting of the American Society of Tropical Medicine and Hygiene, New Orleans, LA with support from the USAID-funded Amazon Malaria Initiative.

reported. As such, the *Regional Bulletin for the Availability of Antimalarial Medicines* has also made it possible to point out potential deviations in prescribing and dispensing practices in countries of the Americas. For instance, presumptive treatment, i.e. the dispensing of antimalarial medicines without a proper laboratory diagnosis, has been suspected.

**Figure 4. Number of Reporting Countries and % of Antimalarial Medicine Stocks at Central Warehouses**



\*MSH/SIAPS country reported data for the period 2012-2014.

### Special Considerations for Countries with Low Incidence

Maintenance of adequate stocks of medicine is particularly important in low-incidence settings and for countries pursuing malaria elimination. Countries with low malaria incidence continued to benefit from assistance provided by the MSH/SIAPS program on needs forecasting, overcoming bottlenecks, and maintaining adequate antimalarial medicine stocks. A minimum level of medicine stocks need to be maintained in locations with few to no cases of malaria, in order to mitigate the risk of outbreaks and avoid the reintroduction of malaria. Pharmaceutical supply management criteria have been developed for low-incidence areas in seven countries, and the criteria have been institutionalized in Colombia, Brazil, and Nicaragua, with Honduras and Nicaragua considering the criteria in procurement planning. The MSH/SIAPS program led a workshop in Colombia that resulted in an agreement on the criteria for programming and distributing antimalarials in low-incidence areas, which in turn helped to determine procurement estimates and distribution of medicines to departmental warehouses. Colombia also made updates to its antimalarial requisitioning and dispatch tool.

### Joint Procurement of Antimalarial Medicines

Countries that have a low incidence of malaria experience challenges with the supply chain for essential medicines because pharmaceutical manufacturers are no longer interested in participating in tenders or other procurement

processes when very small quantities of medicines are solicited. To alleviate this issue, countries in the LAC region have worked with PAHO/WHO and its Strategic Fund unit towards jointly procuring antimalarial medicines. This mechanism allows countries to acquire medicines through standardized ordering procedures, as part of a pooled order, and to benefit from quality assurance and lower prices. Currently, this is the only mechanism through which certain countries can access medicines for malaria. As of FY 2015, a long-term agreement was made for PAHO to procure antimalarials as a result of a tender process completed in collaboration with United Nations Children's Emergency Fund (UNICEF) and WHO. A reference laboratory in Uruguay was hired to perform quality control tests of medicines procured regionally through the Strategic Fund.

As an additional measure, PAHO/WHO has established a fully operational stand-alone regional warehouse in Panama where an emergency stock of antimalarial medicines is stored. The warehouse operates 24 hours a day, seven days a week, and can provide treatments to countries upon request. It has been instrumental in supplying ACTs for malaria cases imported to Central America from areas where resistance to CQ is known, as well as in rapidly mobilizing lifesaving antimalarials for severe cases. In FY 2015, PAHO/WHO facilitated the donation of antimalarials from Brazil to treat severe cases elsewhere, and met urgent requests from Nicaragua, Guatemala, El Salvador, and Belize, including an emergency procurement of antimalarials for Guatemala due to a stock-out in the second quarter of FY 2015. At the end of FY 2015 and beginning of FY 2016, ACTs were distributed from the regional warehouse to 11 countries. Intravenous artesunate and quinine for severe cases were distributed to six countries, including two outside of LAC, whereby the United Nations (UN) system provided lifesaving antimalarial medicines for severe cases in Somalia and Swaziland.

## Strategies for Improving Access to Malaria Diagnosis and Treatment

MSH/SIAPS worked with endemic states in Brazil's Amazon region to assess the implementation of malaria control strategies following an "adequacy" approach.<sup>20</sup> Over the course of 2014, MSH/SIAPS conducted a study of the adequacy of the implementation of: 1) diagnosis and treatment, 2) IRS, and 3) ITNs. During a meeting organized in December 2014, Brazil's MOH and nine malaria-endemic states met to validate and discuss the results of the assessment, with MSH/SIAPS support. States' authorities identified next steps that were incorporated into work plans to close performance gaps for control strategies that had been ranked as deficient. They also scheduled a follow-up monitoring exercise using the same approach for FY 2016.

With regard to ensuring access for key populations, workshops were held with Roraima state authorities and microscopists in April and August 2015. A rapid survey instrument was developed to collect additional information about the mobile and migrant population, including miners, indigenous groups, and others transiting through the state. Through a survey initiated in September 2015, MSH/SIAPS systematized interventions to provide malaria diagnosis and treatment to gold miners in the Brazilian state of Pará. This systematization served as a basis for the *Proposed Intervention to Improve Access to Malaria Diagnosis and Treatment in Mining Areas of Pará, Brazil*.<sup>21</sup>

Colombian officials developed the first draft of a research protocol to estimate the under-reporting of malaria cases at diagnosis and treatment posts in high-burden departments in FY 2015, together with MSH/SIAPS. The data collection protocol and instruments were set for testing at a few health facilities. In addition, in the second quarter of FY 2016, MSH/SIAPS and Colombia's Vector Borne Diseases Control Program completed an evaluation of the implementation of their Integrated Management Strategy for Malaria Control (EGI, by its Spanish acronym) using the adequacy approach.

20 For a description of the adequacy approach, see: Habicht, J et al. 1999. Evaluation designs for adequacy, plausibility and probability of public health program performance and impact. *Int J Epidemiol*, 28: 10-18.

21 URL: <http://siapsprogram.org/publication/propuesta-de-intervencio-para-melhorar-o-acesso-ao-diagnostico-e-ao-tratamento-de-malaria-em-areas-de-garimpo-no-estado-do-para-brasil/>

Guatemala's MOH took advantage of MSH/SIAPS and Links Media's technical assistance with the introduction of guidelines to support malaria pharmaceutical management at primary health facilities and to monitor the availability of antimalarials for use by health volunteers. One poster and four instructional guides on the proper pharmaceutical and case management protocol for malaria cases were created or updated for district-level supervisors, health center staff, and community-level volunteer collaborators. The five materials would later be used at trainings, and subsequently, serve as illustrated job aids.

In March 2015, as part of an AMI site visit to Iquitos in the Loreto Region of Peru, PAHO/WHO and MSH/SIAPS met with national counterparts to identify the areas in which health authorities needed support to respond to the malaria emergency in Loreto. Peru's MOH, with support from MSH/SIAPS, agreed to work on developing a strategy to introduce a new fixed-dose combination treatment of artesunate + mefloquine (an ACT) for *P. falciparum* malaria. In collaboration with national regulatory authorities and NMCP counterparts, the MOH planned for local introduction of this new fixed-dosed combination therapy. This activity began with a pilot test in selected counties of the Loreto Region towards the end of FY 2015. During the first two quarters of FY 2016, Peru received MSH/SIAPS' support for the drafting of an operational plan to scale-up malaria pharmaceutical management interventions in the country.

### **Best Practices for the Management, Storage, and Supply of Malaria Pharmaceuticals**

As part of its continued support to promote best practice guidelines for the management, storage, and supply of malaria pharmaceuticals, MSH/SIAPS provided decentralized assistance to counterparts in Peru's Loreto Region to strengthen their capacity for the proper management and storage of key commodities at medical warehouses. This is highlighted in two success stories below. As a result, the Loreto warehouse became only the second warehouse to receive Peru's nationally conferred Certificate of Good Storage Practices (BPA, by its Spanish acronym).



Photo: Links Media



## Success Story

### *Certification of the regional medicines warehouse in Loreto (Peru)<sup>1</sup>*



Staff that achieved certification, led by Dr. Yuri Cabello, director of DIREMID-Loreto, and Chemist-Pharmacist Ivonne Navarro.

#### **Background Information**

Loreto, in northeastern Peru, is the country's largest region. Traversing the region is a vast network of rivers that empty into the Amazon River Basin. Loreto is characterized by a low population density with 45% of its slightly more than one million inhabitants residing in rural areas.<sup>2</sup> There are 19 indigenous ethnicities in the region. It has a hot, humid, and rainy climate with high temperatures reaching 98°F from October to January and 84% humidity.

The Loreto Regional Health Directorate (*Dirección Regional de Salud*, DIRESA) relies on a network of 374 primary-level health care facilities and three hospitals. Since 2004, medicines and other supplies for malaria control have been distributed to these facilities by the Regional Directorate of Medicines, Supplies and Drugs (*Dirección Regional de Medicamentos, Insumos y Drogas*, DIREMID) from a space that was originally built as a private home and had been modified to serve as a regional warehouse.

An assessment carried out by USAID-funded SIAPS through the Amazon Malaria Initiative (AMI) in May 2012<sup>3</sup> revealed that the storehouse met only 56% (49/88) of the requirements of the national Good Storage Practices regulations (BPA, by its Spanish acronym).<sup>4</sup> This meant that conditions were still deficient, despite DIREMID's efforts. Some of the main problems included: a) insufficient storage capacity; b) lack of organization within indoor areas; c) absence of standard operating procedures and norms for training, organization, and job descriptions; d) untrained staff; e) non-standard work practices that were unsafe for staff, and f) insufficient and inadequate equipment and materials.

#### **Interventions**

In the months following the assessment, SIAPS provided technical assistance to improve the conditions and practices in the regional warehouse, though the implementation of a work plan that required an investment of approximately USD 13,557 of AMI resources.



<sup>1</sup> Technical assistance provided by Henry Espinoza, Senior Technical Advisor, and Edgar Barillas, Portfolio Manager.

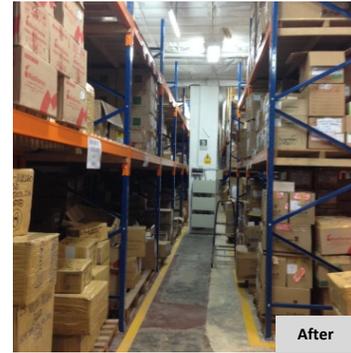
<sup>2</sup> Peru: The projected population is 1,028,968, according to the region on June 30, 2014. Source: National Institute of Statistics and Informatics (INEI) - Peru: Population Estimates and Projections by Sex, according to Region, Province, and District, 2000 - 2015 - Special Bulletin No 18.

<sup>3</sup> Espinoza, Henry. 2012. Baseline assessment of the supply of medicines, materials, and laboratory reagents for malaria control in DIRESA-Loreto, Peru (*Evaluación del suministro de medicamentos, insumos y reactivos de laboratorio para el control de la malaria en la DIRESA Loreto, Perú – Línea de Base*). Submitted to the United States Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

<sup>4</sup> Ministerial Resolution No 585-99-SA/DM approving the Manual of Good Practices for the Storage of Pharmaceutical Products and Related Supplies.



Before



After

**Activities included:**

1. Development, validation, and implementation of a standard operating procedures manual, training guidelines, security guidelines, and a manual with organization and job descriptions.
2. Training of staff on warehouse operations through the creation of apprenticeships at a certified warehouse and training on the implementation of procedures and guidelines.
3. Supervision of adherence to the BPA regulations and adoption of corrective measures.

For its part, DIREMID invested USD 101,028 towards expansion of the storage capacity, improvements to organization within the warehouse, optimization of climate control, and the provision of work equipment and material to facilitate operations and ensure greater safety for people and products. It is important to note that this investment was seven times greater than that provided in technical assistance by USAID/SIAPS.



**Impact**

In December 2014, the General Directorate of Medicines, Supplies and Drugs inspected the regional warehouse in Loreto and gave it a Certificate of Good Storage Practices for complying with 100% of the requirements. Loreto's specialized warehouse is only the second warehouse that has been certified in the whole country.

**See also:** [Success Story: Decentralized technical assistance from the Amazon Malaria Initiative improves antimalarial supply management in Loreto, Peru](#)





## Decentralized technical assistance from the Amazon Malaria Initiative improves antimalarial supply management in Loreto, Peru<sup>i</sup>

“We do not view the increase in the number of malaria cases as a problem of supply, because we have available adequate inventories.”  
(SISMED Director, DIRESA-Loreto)

### Background

The region of Loreto, in northeastern Peru, is the country’s largest. Traversing the region is a vast network of rivers that empty into the Amazon River Basin. Loreto is home to just over 1 million inhabitants,<sup>ii</sup> some 45% of whom reside in rural areas characterized by low population density. Poverty and illiteracy (35% and 6%, respectively, in Loreto)<sup>iii</sup> are greatest among the 19 indigenous ethnic groups who call this region home. A variety of environmental, geographic, and socioeconomic conditions make malaria a prevalent problem here—and one that has proved difficult to control. In 2013, this region accounted for almost 90%<sup>iv</sup> of Peru’s total cases. Cases reported in that year showed an increase of 73% over 2012.

To control this epidemic, the Loreto Regional Health Directorate (Dirección Regional de Salud; DIRESA) relies on a network of 374 primary-level health care facilities and three hospitals, all of which provide both individual and group health care. Medicines and other supplies<sup>v</sup> used to control malaria are distributed by the Regional Directorate of Medicines, Supplies and Drugs (Dirección Regional de Medicamentos, Insumos y Drogas; DIREMID) using its Integrated Supply System for Medicines and Medical Supplies (Sistema Integrado de Suministro de Medicamentos e Insumos; SISMED). Antimalarials and other medicines used in public health interventions are procured and distributed nationally by the Directorate for Supply of Strategic Resources (*Dirección de Abastecimiento de Recursos Estratégicos*) pursuant to programming prepared by DIREMID.



Because of the increase in the number of cases, particularly in the region of Loreto, Peru’s National Health Strategy for the Control of Vector-Borne Diseases (*Estrategia Sanitaria Nacional de Control de Enfermedades Metaxénicas*) requested technical assistance from SIAPS<sup>vi</sup> to assess the current status of antimalarial supply and support the implementation of corrective measures.

The baseline study carried out in May 2012 revealed the following: (a) inadequate programming of medicines, with a failure to take into account not only the increase in the number of malaria cases but also antimalarial use by itinerant health brigades for additional interventions seeking out passive cases; (b) delays in medicine purchases resulting from a lack of national providers and regulatory restrictions affecting purchases made on a sole-source basis and all international purchases; (c) poor



June 2015

storage conditions and practices affecting medicine quality and inventory management; (d) absence of a standardized distribution procedure, which led to inconsistencies between amounts ordered and amounts dispatched, quantities delivered insufficient to meet demand, increased frequency of emergency orders, and delays in delivery; and (e) low levels of personnel trained in the supply of medicines and medical supplies (particularly in areas located at some distance from the capital city), absence of self-instructional materials, and lack of a training strategy based on staff characteristics and geographic accessibility within the region. All of these problems led to medicine shortages: six of nine antimalarials showed shortages of between 8 and 157 days during the 12-month period prior to the study. Mean availability<sup>vii</sup> in health facilities was 50%.

### Interventions

Based on these results, starting in July 2012, SIAPS began providing support to various interventions that led to improvements in regional medicine supply.

1. The implementation of standardized forms and procedures for placing orders and dispensing medicines and medical supplies, maintaining reserve stocks, and periodically monitoring inventories
2. The development and application of new programming and distribution criteria
3. The coordination of donations from Brazil, Ecuador, and Colombia (313,700 units, valued at USD 28,004) to mitigate problems with national procurement
4. The improvement in storage conditions and practices in the regional warehouse<sup>viii</sup> and in subregional warehouses and health facilities
5. Development of graphic self-instructional materials based on malaria technical standards and appropriate medicine distribution procedures

### Results

An impact assessment carried out in March 2014<sup>ix</sup> showed a fourfold increase (411%) in the units needed required to be purchased from 2011 to 2013; an increase in availability of distribution procedures in health facilities from 8% to 60%; an increase from 62% to 80% in the number of facilities that received the quantity of medicines they ordered and an increase from 62% to 100% in the number that received supplies on the anticipated date. Emergency orders dropped from 38% to 20%, and the number of facilities with expired products decreased from 33% to 8%.

Although six of the nine antimalarials were affected by stock-outs (of between 8 and 157 days) in the regional warehouse during the 12 months preceding the baseline study (May 2012), only one reflected a stock-out following the intervention, and this was attributable to problems with national procurement. Mean availability of drugs in health facilities increased from 50% to 72%.



### Conclusion

Decentralized interventions in Loreto decreased stock-outs from the second half of 2012 through the first quarter of 2014.

Even in geographically remote areas, the management of antimalarial supplies can quickly be improved by means of a systematic



intervention combining the introduction of improved programming criteria, purchases made on a timely basis and in appropriate amounts, optimization of the distribution network, establishment of strategic stock levels, and improvements in training using selectional materials.

**See also:** [Success Story: Certification of the regional medicines warehouse in Loreto \(Peru\)](#)

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<sup>i</sup> The Amazon Malaria Initiative (AMI) is financed through support from the US Agency for International Development. The Systems for Improved Access to Pharmaceuticals and Services (SIAPS) program, an AMI member, supported this decentralized technical assistance initiative.

<sup>ii</sup> Projected population totals 1,028,968, by department, as of June 30, 2014. Instituto Nacional de Estadística e Informática (INEI), *Perú: Estimaciones y Proyecciones de Población por Sexo, según Departamento, Provincia y Distrito, 2000-2015*, Boletín Especial Nº 18 (Lima, Diciembre 2009).

<sup>iii</sup> INEI, *Evolución de la pobreza monetaria en el Perú al 2013* (Mayo 2014).

<sup>iv</sup> Ministerio de Salud, Dirección General de Epidemiología, *Boletín Epidemiológico* 52 (2013).

<sup>v</sup> Supplies include slides, lancets, alcohol, and cotton.

<sup>vi</sup> Since 2002, Management Sciences for Health has been an AMI partner, providing technical assistance through its RPM Plus and SPS programs, and now through SIAPS (Systems for Improved Access to Pharmaceuticals and Services).

<sup>vii</sup> Defined as the mean percentage of medicines available in a given health facility, based on the medicines required for the type of malaria frequent in that area (adults, children, pregnant women, and if appropriate for severe malaria) and medicines for adult treatment of the bacterial strain that is not frequent.

<sup>viii</sup> In December 2014, the Loreto regional warehouse received certification in Good Storage Practices from the Ministry of Health's General Directorate for Medicines, Supplies and Drugs.

<sup>ix</sup> Espinoza, Henry. 2014. *Suministro de medicamentos, insumos y reactivos de laboratorio para el control de la malaria en la DIRESA Loreto, Perú – Evaluación post intervención*. Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.



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## FY2015 Highlights

- Belize, Colombia, Guyana, Nicaragua, Panama, and Peru received PAHO/WHO technical support to revise their national treatment guidelines.
- MOHs received Pharmaceutical Reference Standards (PRS) for antimalarial medicines from PAHO/WHO and USP.
- Countries submitted additional data on antimalarial consumption for inclusion in the quarterly bulletin on medicine stock-levels at central warehouses.
- Peru's regional warehouse in the Loreto Region obtained the national BPA.
- A regional "Rapid Assessment of Malaria Pharmaceutical Management in AMI Countries" was completed and disseminated by MSH/SIAPS in Spanish. The report was based on data collected in seven countries from January–August 2014. Data covered the performance of distribution systems, the percentage of medicine availability versus stock-outs, and the time to fulfill requests. This followed up on a previous regional assessment disseminated in 2012.
- PAHO secured a long-term antimalarial procurement agreement with collaboration from UNICEF and WHO.
- In Panama, a stand-alone regional warehouse with an emergency stock of antimalarial medicines became fully operational 24 hours a day, seven days a week. In the fourth quarter of FY15, the warehouse distributed:
  - ACTs to 11 countries;
  - Antimalarials for severe cases to six countries, including Somalia and Swaziland.

## Implementation Challenges

The number of countries reporting antimalarial stock data oscillated between quarters, with nine out of 11 countries reporting in the first quarter of FY 2016. This fluctuation could impact regional monitoring of antimalarial medicines and result in a decreased utility in preventing stock-outs; indeed, stock-outs were reported at the central level in three countries in quarter two of FY 2016. Country focal points may need to be re-trained on the PRAIS e-platform or given additional assistance to ensure that data is submitted through the system. Moreover, PAHO/WHO focal points in AMI countries need to continue to coordinate with NMCP staff on data collection regarding antimalarial stocks. In the long term, PAHO will continue to play an important role in encouraging countries to dedicate sufficient time and resources to regional reporting.

Now that countries in the RAVREDA network have experience in collecting and reporting on stock data, the challenges are to better analyze the data and to utilize the resulting information. Doing so could help predict issues that may arise in antimalarial management, such as health professionals' compliance with treatment guidelines, including the possibility of treatment being prescribed or dispensed without a laboratory diagnosis; or the risk of artemisinin mono-therapy due to a stock-out of mefloquine, as noted in Peru.

A few countries continue to pursue local procurement of antimalarials, despite all AMI-supported countries are eligible to use PAHO's Strategic Fund and participate in the joint procurement of these essential medicines. In fact, many countries have taken advantage of this mechanism, though their adherence to procurement procedures and timeframes have not always been adequate. For example, a late submission of purchasing requests by a country may result in failure to participate in the pooled procurement and stock-outs in prejudice of patients.

In FY 2015, some ministers of health did not make use of a line of credit extended to them by PAHO/WHO to facilitate (by avoiding anticipated payment) procurement through the Strategic Fund of essential medicines for AIDS, tuberculosis and malaria. There may be a lack of awareness among these key decision-makers about the functioning of the Strategic Fund, which could be addressed through more effective provision of information by AMI partners.

Finally, following Peru's achievement of the good storage practices certification of a regional medicines warehouse in Loreto, it is now up to the regional authorities to maintain the conditions (infrastructure, equipment, staff, etc.) that made the certification possible. This warehouse and other similar decentralized warehouses play an important role in the national system to address malaria and other diseases; therefore, they will require continual support from health authorities.

## 2.2.b Antimalarial Medicine Quality

Successful control and elimination of malaria depend on safe and effective antimalarial medicines. National health systems are responsible for guaranteeing the quality of antimalarials and other supplies. MRAs and OMCLs have recently done more to institutionalize evidence-based practices like the Three Level Approach that was first introduced by PAHO/WHO and the Promoting the Quality of Medicines (PQM) Program implemented by USP. The Three Level Approach to medicine quality control is a cost-effective, fast, and reliable methodology that allows the assessment of a large number of medicines in the field. This methodology consists of sequential and complementary levels of quality control of increasing complexity.

The three levels of medicine quality control are:

**Level 1** – Visual and physical inspection

**Level 2** – Rapid analytical screening tests that can be performed in the field

**Level 3** – Registration methodologies that require an established laboratory and trained personnel

USAID's support to countries through AMI has emphasized strengthening the capabilities of OMCLs to perform analytical tests according to compendial methods, and assisting them to ensure that their quality management systems comply with internationally recognized standards of operation. This is important for Level 3 in the context of implementing the Three Level Approach to quality monitoring carried out by MRAs and decentralized health areas in support of malaria program goals.

PAHO/WHO and USP/PQM regularly coordinate on activities that contribute to the quality of antimalarial medicines by strengthening countries' QA/QC systems. For example, PAHO/WHO collected a random sample of antimalarial drugs procured by Belize, Brazil, Colombia, Ecuador, and Guyana and confirmed that medicines procured for these countries through the Strategic Fund met the required quality standards. In one country where locally-procured medicines showed inconsistent quality, PAHO/WHO and USP worked to correct the problem. Additionally, PAHO/WHO has facilitated communication between AMI-supported countries and USP to procure PRS for antimalarial medicines through the Regional Malaria Program and country offices. USP's sending of PRS enables countries' OMCLs to analyze medicines on a routine basis.

During FY 2015 and the first two quarters of FY 2016, the PAHO/WHO Essential Medicines unit provided support to strengthen laboratory QA in AMI-supported countries. The installed capacity will serve to control the

quality of antimalarials procured through the PAHO/WHO Strategic Fund and disseminate medicine quality testing results to participating countries.

## Regional Workshop on Medicine Quality

In collaboration with PAHO/WHO, USP/PQM organized a regional workshop on medicine quality in Lima, Peru from November 11–13, 2014. The workshop's objective was to identify sustainable mechanisms to continue South–South collaboration for the quality assurance of medicines. Sixteen LAC countries were represented, with officers of MRAs, OMCLs, and academia in attendance. As a result, a survey instrument was developed by country representatives and PQM, through which regional OMCLs and MRAs subsequently reported their medicine QA/QC capabilities and needs.

The following are highlights and conclusions drawn from the survey responses USP/PQM obtained from 9 MRAs and 18 laboratories (14 OMCLs and 4 Schools of Pharmacy) with regard to regional collaboration for medicine quality:

1. Most MRAs (67%) and OMCLs (67%) are compliant with one or more internationally recognized standards of operation (e.g. Reference PAHO, PIC/S, ISO 9001:2008, ISO 17025:2005, WHO Prequalification).
  - This finding not only indicates that many LAC countries have the expertise to support other countries in the region to attain compliance, but also shows the overall good standing of the region as a whole in its compliance with internationally recognized operational standards.
2. The region has the expertise to provide assistance in all (27/27) technical areas identified as necessary by the OMCLs and most (6/7) of those considered for the MRAs. The only one not identified in the region, Good Distribution and Transportation Practices, is not critical for MRA functioning.
  - This indicates that South–South collaborations are a plausible mechanism through which countries can receive technical assistance according to their needs.
  - The results also show the good standing of the labs in the region as a whole, since more than 40% of the laboratories are proficient in more than 50% of the tests (14/27; 52%). Note: This statistic includes the responses of 14 OMCLs and 4 university labs. The assistance provided by AMI partners over the years has contributed to this high level of proficiency.
  - No single country has expertise in all the technical areas. This result shows that using a regional approach supports all countries in the region to some extent.
3. Collaborations with universities are widespread among MRAs (56%) and OMCLs (64%).
  - Strengthening partnerships with academia promotes not only the technical support to OMCLs and MRAs, but also contributes to universities having a better understanding of public health needs on the frontlines of care, which helps them to tailor their curricula to satisfy these needs.

Survey responses validated the premise that identifying a sustainable mechanism for South–South collaboration could offer the LAC region the means to advance in establishing or maintaining proper QA/QC systems in all countries and ensure the quality of medicines for public consumption. After receiving input from a multi-country, multi-sectoral committee formed at the Lima workshop, USP/PQM sent a concept note entitled “Exploring Sustainable Mechanisms for South–South Collaboration on Medicine Quality” to the MOHs of participating countries as a follow-up action in May 2015.

## Decentralized Support in Peru

In follow-up to an AMI partners' meeting in Iquitos, Peru, the Loreto and Madre de Dios regional health authorities coordinated with USP/PQM to perform Level 2 analyses on all medicines using Minilab™ methodologies. In addition, from April to May 2015 PAHO/WHO conducted an internal study of how intravenous artesunate was being used to treat severe malaria cases in Loreto. Physicians' and nurses' practices at the main hospitals in Iquitos were investigated, and PAHO recommended a capacity building exercise for health professionals in FY 2016. Colombia also received targeted support to ensure that treatments for severe cases were used appropriately.



Photo: USP/PQM



# AMAZON MALARIA INITIATIVE

## SUCCESS STORY

### PERU STRENGTHENS ITS MEDICINE QUALITY CONTROL APPROACH

Poor quality medicines that fail to meet official standards pose a significant threat to patients in need of quality-assured medicines to combat diseases such as malaria, for which proper treatment is essential to eliminate parasites from the blood effectively. Lack of quality-assured medicines can delay progress towards malaria control and eventual elimination.

From January to June 2015, 60% of 124 counterfeit products that were analyzed under orders from Peru's General Directorate of Medicines, Supplies and Drugs (DIGEMID) did not contain an active ingredient. These medicines could have been identified rapidly in the field with screening tests, allowing more prompt regulatory action.

In order to strengthen the capacity of Regional Health Directorate (DIRESA) staff and university labs, in August 2015 DIGEMID and the National Center for Quality Control (CNCC) convened a training workshop in Cuzco with the participation of six universities and six DIREASAs. Of the six DIREASAs in attendance, five (La Libertad, Ayacucho, Loreto, Tacna and Cuzco) had reported the highest rates of substandard and counterfeit medicines in the country.

During the workshop, CNCC trained participants on the use of rapid field tests. The head of Peru's National Institute of Health (INS) pointed out that field screening tests drastically reduce the time needed to assess medicine quality, from several months down to a few hours or days, depending on the number of samples to be analyzed. Expanding the



Photo Credit: CNCC

**Workshop participants received training on Level 2 of the Three Level Approach for medicines quality control, at the National University of San Antonio Abad's Pharmaceutical Technology Laboratory.**

use of rapid field tests for the monitoring of medicines at the decentralized level would allow for more prompt regulatory action and a larger volume of medicines screened.

The methodology that Peru chose to adopt and began to scale up with the critically important August 2015 workshop is known as the Three Level Approach to medicine quality control. The Three Level Approach is a globally-proven methodology to detect substandard and counterfeit



medicines in a rapid and cost effective manner. It consists of preliminary visual and physical inspection (Level 1), rapid screening field tests (Level 2), and compendial or other validated laboratory tests (Level 3).<sup>1</sup> It was first introduced in the Americas through the Amazon Malaria Initiative (AMI), by implementing partner USP's Promoting the Quality of Medicines Program.

Starting with the workshop in Cuzco, the six participating universities began the process of being integrated into a network to support the CNCC with supplemental technical and human resources for the decentralized quality control of medicines at the DIRESAs. The inclusion of university laboratories to cooperate with medicine quality monitoring in the field is intended to enhance Peru's capacity to ensure the quality of medicines on the market.

Also in 2015, Peru developed an annual timeline for the DIRESAs in Loreto and Madre de Dios to analyze the

quality of a list of medicines. Medicine samples that fail field tests will be sent to the CNCC immediately to expedite confirmatory testing.

The involvement of universities in the August 2015 workshop demonstrates DIGEMID and CNCC's commitment to nationwide implementation of the Three Level Approach and to further strengthening the country's capacity to survey medicine quality in the field. Peru now has concrete plans to invest in long-term, sustainable solutions to facilitate the identification and removal of poor quality medicines from its territory, made possible with technical support provided through AMI.

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**The Three Level Approach**

The Three Level Approach applies sequential and complementary levels of quality control of increasing complexity, which are:

- Level 1** – Visual and physical inspection
- Level 2** – Rapid analytical screening tests that can be performed in the field
- Level 3** – Registration methodologies that require an established lab and trained personnel

The Three Level Approach, developed by PQM to support countries' post marketing surveillance programs, was introduced and implemented initially in AMI countries through PQM assistance. Countries' implementation of Level 2 analysis helped to assess more than 1600 malaria medicines from 2005-2010.<sup>2</sup>



Photo Credit: PAHO/WHO

1. Pribluda VS, Barojas A, Coignez V, Brady S, Dijiba Y, et al. (2014) The Three Level Approach: A Framework for Ensuring Medicines Quality in Limited-Resource Countries. *Pharmaceut Reg Affairs* 3:117  
2. Pribluda VS, Barojas A, Añez A, López CG, et al. (2012) Implementation of basic quality control tests for malaria medicines in Amazon Basin countries: results for the 2005–2010 period. *Malaria Journal* 11:202.

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## Institutionalization of Medicine Quality Control Procedures in Peru, Colombia, and Ecuador

In August 2015, Peru's DIGEMID developed an annual timeline for two DIRESAs to verify the quality of pharmaceutical products using the Three Level Approach. In addition to the monitoring of official medicines, counterfeit antimalarial medicines were to be analyzed using rapid tests as well. CNCC trained six universities and six additional DIRESAs on the use of rapid field tests. This represents a significant expansion of the country's capacity to monitor medicine quality in the field.

In order to expand the range of medicines that can be tested in the field, USP/PQM supported Peru and Colombia to develop protocols for medicines of interest not included among those that could be analyzed with the standard equipment for rapid field tests (Minilabs™). In August 2015, USP/PQM delivered advanced trainings to Peru and Colombia's OMCLs to support the development of new analytical methods for medicine quality control. USP trained personnel from MRAs and OMCLs on the validation of analytical procedures, in order for those procedures to be recognized by national health systems. Validation of new rapid testing methods and procedures will enable regulatory agencies to adopt protocols for regular quality monitoring. Further expansion of screening programs is planned with the involvement of the Global Pharma Health Fund, which produces the rapid testing equipment known as Minilabs™.

In Ecuador, The National Medicine Regulatory Agency (ARCSA, by its Spanish acronym) created in 2013, included the Three Level Approach as one of its modalities for post-registration medicine quality monitoring in FY 2015. As a result, Level 2 rapid analytical tests for pharmaceutical quality control began to be used as tools for ARCSA's regular activities on a semi-annual basis. A detailed implementation plan was developed for field testing of all classes of medicines in Ecuador, including drugs for malaria, tuberculosis, and other diseases. To support this reinstatement of the Three Level Approach in Ecuador, USP/PQM provided PRS and guidelines for Level 2 tests, as well as donated a number of the supplies that were needed. Finally, ARCSA developed a semi-annual implementation program for conducting Level 2 quality monitoring.

Through a USP/PQM initiative in early 2016, Peru's CNCC began collaborating with the Global Pharma Health Fund, producers of the Minilab™ rapid field tests, for the development of field screening technologies to assess medicines currently in use in Peru. The thin layer chromatography (TLC) protocols developed would later be included in the Minilab's manual of analytical procedures. This was the first collaboration established between an OMCL and the Global Pharma Health Fund for the development of new methods for the Minilab™; this work represented important cooperation, resulting in the enhancement of not only the analytical capabilities of Peru, but also wherever Minilabs™ are used in the world.

### **Innovation: Digital Application to Assist in Level I Testing of Medicines**

The process of developing a web-based application as an innovative tool to augment QA/QC capacity in the field by strengthening regulators' ability to perform visual and physical inspection of medicines (Level 1) continued to advance in FY 2015 and the first two quarters of FY 2016. The tool will allow in situ access to a pharmaceutical database that includes registration specifications and images of registered medicines. Moreover, the database is to be accessible through computers and mobile devices. Deployment of a prototype of the tool in selected pilot countries, including Peru and Ecuador, was planned for FY 2016. Since this tool could also be utilized in other regions as well, support for its development was provided through outside funding streams.

## FY2015 Highlights

- Representatives of 16 LAC countries convened at a regional workshop on sustainable South–South collaborations for the quality assurance of medicines, organized by USP/PQM in Lima, Peru in November 2014. Data on national capacity and needs were collected and analyzed, resulting in a concept paper that was sent to the region’s MOHs in May 2015.
- Brazil’s NMCP signed an agreement with PAHO/WHO and the Federal University of Minas Gerais to provide Level 3 compendial tests as part of the country’s new medicine quality program, known as PROVEME. This built on the prior implementation of Level 1 and 2 tests in selected malaria-endemic states. Per the agreement, sampling of medicines will be done at the central warehouses, as well as at decentralized warehouses in Acre, Amapá, and Roraima states.
- Ecuador reinstated the Three Level Approach with knowledge transfer and donation of materials from PAHO/WHO and USP/PQM.
- At a workshop in Cuzco in August 2015, Peru advanced the institutionalization of the Three Level Approach to medicine quality control. The approach promoted by USP/PQM under AMI was set for expansion to new DIREASs with participation from Peruvian universities.
- Guatemala’s OMCL received ISO 17025 accreditation from the National Accreditation Board (ANAB, by its Spanish acronym) in September 2015, moving from a product-based to a method-based accreditation. The expanded scope of this accreditation includes high-performance liquid chromatography (HPLC) testing, as well as spectrophotometry and dissolution tests, strengthening the country’s capacity to ensure the quality of medicines, including antimalarials. PQM’s support to earn accreditation was initially provided through AMI, and was later financed through USAID/Guatemala.

## Challenges to Implementation

While involving numerous actors such as university laboratories and schools of pharmacy in national medicine QA/QC systems has a clear sustainability benefit, the distinct agendas of each institution participating in medicine quality control partnerships may introduce difficulties. Priorities and interests need to be aligned in order to ensure the smooth operation of medicine quality assurance processes. In addition, the laboratory capacity of partners at the decentralized level remains uneven in many countries, and requires strengthening to ensure optimal performance of routine testing.

Medicine quality improvements and knowledge management should be maintained at the institutional level; however, this is difficult due to the frequent turnover in health authority, MRA, and OMCL personnel. National health reforms such as those that have taken place in Guatemala, Honduras, and Ecuador can also result in the disappearance of entire divisions within MOHs. This presents an obstacle to sustaining good practices for antimalarial medicine quality monitoring in the long term.



Photo: PAHO/WHO

## 2.3 MEDICINE EFFICACY AND RESISTANCE MONITORING

Systematic monitoring of parasite resistance to antimalarial medicines has been a focus of AMI and RAVREDA since their inception. Standardized resistance surveillance guidelines and protocols have been in place in AMI/RAVREDA countries for years, in order to assess current first-line treatments for malaria. *In vivo* and *in vitro* studies have been conducted in AMI-supported countries periodically to test the therapeutic efficacy of standard treatment regimens and changes have been made when necessary. In the early 2000s, study results that confirmed CQ resistance led eight Amazon basin countries to make ACTs the first-line treatment for *P. falciparum* malaria.

Antimalarial medicine resistance surveillance is currently done in areas with varying transmission levels. AMI emphasizes the constant updating of national treatment guidelines based on the scientific evidence and the proper dissemination of those guidelines to health professionals. Ongoing antimalarial medicine efficacy studies allow for the evaluation of alternative treatments for the guidelines. AMI partners PAHO/WHO and CDC have provided significant technical assistance to NMCPs, both to assess antimalarial resistance patterns and to revise national treatment guidelines.

### Artemisinin Resistance Monitoring Using *In Vivo* Studies

Emergence of resistance to artemisinin in Southeast Asia has caused major concern in global malaria control efforts, prompting AMI partners to take a proactive approach to prevent or contain the emergence of artemisinin resistance in LAC. Preliminary signs of reduced sensitivity to artemisinin in the Guiana Shield sub-region of South America in 2012 spurred a multi-country response to strengthen antimalarial resistance surveillance. In 2013–2014, Guyana and Suriname carried out confirmatory *in vivo* studies conducted according to the WHO's Global Malaria Program protocol, with the benefit of PAHO/WHO supervisory visits during the study period, and, of CDC later performing a review of the slides from the studies.

PAHO/WHO organized a meeting in Paramaribo, Suriname from November 11–13, 2014 to follow up on these efficacy studies confirming the sub-regional parasite response to artemisinin. AMI partners attended this and other high-level meetings on the topic of artemisinin resistance in the sub-region. No evidence of artemisinin resistance was found as it is currently defined by the WHO, and it was concluded that in both Guyana and Suriname the ACT artemether+lumefantrine remained efficacious for treating *P. falciparum* malaria.

Currently, all AMI countries that use ACTs implement Day 3 surveillance on *P. falciparum* positive patients as an early warning system to detect any possible loss in sensitivity to ACTs. Patient cure rate data are collected at sentinel surveillance sites throughout the Amazon basin. Selected South American countries have also begun measuring the therapeutic efficacy of ACTs by quantifying the proportion of treatment failures in patients at 28- or 42-day follow-up, depending on the specific ACT. Planning has commenced in French Guiana and Brazil to implement *in vivo* studies in areas that border Suriname and Guyana. Meanwhile, an *in vivo* clinical trial to test the efficacy of artemether+lumefantrine for the treatment of *P. falciparum* malaria commenced in Cruzeiro do Sul, Brazil, in December 2015.

Central American countries that receive AMI support follow a routine surveillance system for all positive *P. falciparum* cases, using the Day 3 monitoring approach and molecular markers to detect possible resistance to CQ as the first-line treatment.

PAHO/WHO and the CDC continued to provide the region with technical assistance to monitor the therapeutic efficacy of antimalarial medicines in FY 2015.

## Genetic Markers of Resistance

Beginning in FY 2015, AMI supported analyses of *P. falciparum* parasite samples from Guyana and Suriname for the presence of the Kelch-13 (K13) genetic mutation that has been identified as a marker of artemisinin resistance in Southeast Asia. The goal of the analyses was to establish a sub-regional baseline and subsequently document the emergence of artemisinin resistance, should it occur. If *P. falciparum* parasites develop resistance to artemisinin and partner drugs used in ACTs, the region will be hard-pressed to find a suitable alternative. In Southeast Asia, it has been shown that antimalarial resistance can either spread, or arise independently.<sup>22</sup>

In a retrospective review of *P. falciparum* samples collected in Guyana, mutations were found in the K13 gene associated with resistance to artemisinin. CDC tested 98 *P. falciparum* samples collected in Guyana in 2010 using Sanger sequencing, and preliminary results showed that five samples (5.1%) carried the K13 mutation. This finding raised concerns, in spite of the fact that it is not conclusive without clinical data. However, no K13 mutations were detected among samples from Guyana collected in 2014. Meanwhile, the CDC also tested 40 *P. falciparum* samples collected in Suriname from 2013–2014. The K13 propeller domain was PCR-amplified using established laboratory protocols, and sequencing was also done using the Sanger method. None of the samples from Suriname had the artemisinin resistance-associated K13 mutant alleles. Nevertheless, an analysis of neutral microsatellite data showed that haplotypes found in parasite samples from Suriname were similar to those previously reported in Guyana, Venezuela, and Brazil, which indicated an apparent mobility of the parasite populations in this area.

Another finding was that resistance alleles that the CDC found circulating in Guyana and Suriname differed from the ones found in Southeast Asia, but were similar to one another. This suggests that the parasite strains may have a common origin. It has not yet been confirmed that K13 mutant alleles are associated with artemisinin resistance in the Americas. Regardless, the independent emergence of K13 mutations in different geographic areas is a trend that AMI partners see the need to monitor continuously using molecular analysis techniques. AMI partners have recommended regular molecular surveillance and *in vivo* assessments of artemisinins, as well as of other partner drugs used in ACTs.

Finally, PAHO/WHO led the development and validation of *The Framework for Artemisinin Resistance Containment and Elimination in South America*.<sup>23</sup> As a result, AMI aims to inform decision-makers in South America about the benefits of taking action to eliminate *P. falciparum* malaria, given the likelihood of parasites developing resistance to ACTs. To support outreach to such audiences, an AMI fact sheet on Antimalarial Medicine Resistance in LAC was developed and disseminated by Links Media in January 2015.

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22 Takala-Harrison, S et al. 2015. Independent emergence of artemisinin resistance mutations among *Plasmodium falciparum* in Southeast Asia. *J Infect Dis* 5:211.

23 Editing currently in progress. Publication is expected in 2016.

## **P. vivax Efficacy Studies**

Patient follow-up for an *in vivo* efficacy study in the municipality of Cruzeiro do Sul, Acre state, Brazil ended in December 2014. The CDC made a final supervisory visit and subsequently helped local investigators to prepare a manuscript on the results of an *in vivo* therapeutic efficacy study of the current first-line treatment for *P. vivax* in the Brazilian Amazon. The implementation of the study helped to develop the local capacity to follow WHO protocols with MOH and CDC assistance, and in December 2015 the same personnel were engaged to initiate a new *P. falciparum* efficacy study in Cruzeiro do Sul as described above.

In the Central America sub-region, the WHO recommends using molecular markers of resistance due to very low malaria transmission. Blood samples have been collected from patients being treated for *P. falciparum* malaria in Guatemala, Honduras, Nicaragua, and Panama for routine monitoring of antimalarial resistance. During FY 2015, PAHO/WHO assisted with the collection of filter paper samples and sent those samples to the CDC for molecular analysis of resistance markers. A percentage of the slides taken at the same time as the filter paper samples also received microscopy quality control readings at the CDC.

## **FY2015 Highlights**

- Belize, Colombia, Guyana, Honduras and Nicaragua received PAHO/WHO technical support to revise their national treatment guidelines. In addition, Honduras and Nicaragua aligned their national treatment guidelines to help address the issue of population mobility along the border.
- Guyana received assistance from AMI partners to review and update its national strategic plan in order to ensure the continued efficacy of antimalarial medicines used in the country.
- CDC conducted K13 artemisinin-resistance associated gene testing on *P. falciparum* isolates from Guyana and Suriname; samples from 2013-2014 showed no K13 mutant alleles, however 5.1% of a set of 2010 samples from Guyana had the K13 mutation associated with resistance in Southeast Asia. Filter paper samples have been collected in Guyana to follow up on K13 molecular markers in collaboration with WHO, CDC, and the Pasteur Institute in Cayenne, French Guiana.
- Antimalarial medicine efficacy and resistance protocols were incorporated into Colombia's surveillance system.
- PAHO/WHO prepared SOPs in collaboration with Honduras' National Reference Laboratory for collection of blood samples on filter paper, as well as for correct packing and shipping of samples. The SOPs were subsequently shared with AMI countries.
- In Nicaragua and Honduras, parasite samples were collected and analyzed as part of prospective antimalarial resistance monitoring using molecular markers. PAHO/WHO and CDC provided support for quality control.

## **Implementation Challenges**

More studies are needed to validate K13 as a molecular marker of artemisinin resistance in the LAC region. To confirm the validity of this marker in the region, the WHO requires establishing a correlation between K13 mutant alleles with slow clearance in clinical studies, reduced drug sensitivity in *ex vivo* or *in vitro* assays, or reduced *in vitro* sensitivity in transfection studies involving insertion of the mutant K13.

Some countries in the region still struggle to meet the minimum WHO requirements for activities conducted as part of the routine monitoring of antimalarial medicine efficacy, such as:

- Use of WHO templates and data analysis programs, microscopy guidelines, and training tools;
- Standardized microscopy readings by two experts and one layer of internal or external quality control;
- Difficulty of recruiting participants for *in vivo* efficacy trials, accompanied by an increased number of variables that require attention as part of routine surveillance of antimalarial efficacy and resistance;
- Following a standard *in vivo* study protocol, including respect for patient confidentiality and other ethical standards that satisfy institutional review board or ethics committee approval for human subjects research;
- Systematic monitoring to detect the presence of K13 mutant alleles, and their association with emergence of resistance to artemisinin;
- Use of molecular markers in very low-transmission settings.

Greater capacity building and supervision of *in vivo* trials are needed where deficiencies exist. In addition, a reinforcement of routine microscopy capacity is also recommended.

The WHO no longer recommends Day 3 parasite clearance protocols because partner drug resistance is as much of a concern as artemisinin resistance. Depending on the ACT used, full 28- or 42-day follow-up is recommended. However, loss to follow-up is a serious concern given the remote and mobile populations most at risk for malaria in the Guiana Shield sub-region of South America and elsewhere in the LAC region. It is therefore a challenge to improve beyond the Day 3 protocols.



Photo: PAHO/WHO

## 2.4 VECTOR SURVEILLANCE AND CONTROL

Vector surveillance and control remain important interventions for the region. AMI provides technical assistance to countries to improve local capacity and knowledge of IVM through partners PAHO/WHO and the CDC. Country-level assistance has included support for monitoring, detection, and management of insecticide resistance, with technical assistance for improved vector surveillance, evaluation studies on the implementation and efficacy of vector control interventions such as LLINs and IRS, promoting and implementing the AMI Strategic Orientation Document (SOD) for vector surveillance and control, and providing follow-up results from insecticide resistance sentinel sites.

PAHO/WHO and CDC have collaborated on providing assistance to partner countries, such as by undertaking a regional needs assessment for vector surveillance and control. Both partner organizations have been working closely to establish the terms of reference for Vector Control Needs Assessments (VCNAs) in Belize and Brazil, which are scheduled for FY 2016. In Guyana, PAHO is working to provide training on IVM for regional focal points in November 2015. In addition, PAHO/WHO and CDC have formulated a response to Peru's request to assist in the development of a national insecticide resistance management plan.

In Peru, PAHO/WHO and CDC have provided in-country support continuing to collaborate with counterparts in the INS on vector control and insecticide resistance management. This has included a demonstration project, site visits in the Loreto Region, and a PAHO-led training in May–June 2015. Additional support from the CDC included an evaluation of LLIN efficacy in San Juan Bautista, Loreto together with INS and US NAMRU-6, with the aim of improving vector control strategies. Furthermore, the CDC hosted an entomologist from Peru's INS at their headquarters in Atlanta, USA from August–September 2015 for additional training on the molecular detection of insecticide resistance mechanisms in malaria vectors. CDC also provided assistance to INS in the interpretation of insecticide resistance data to make recommendations for vector control. Peruvian and CDC researchers published in the *Malaria Journal*, in February 2015, the article “Novel Mutations on the ace-1 gene of the malaria vector *Anopheles albimanus* provide evidence for balancing selection in an area of high insecticide resistance in Peru.”

In Guatemala, the CDC completed an evaluation of GFATM-procured LLINs in operational conditions that had begun in 2014. Data analysis is ongoing. Additional activities included the characterization of insecticide resistance, in which CDC has provided assistance to the Guatemalan authorities and partners with data interpretation and outlining of next steps for resistance monitoring. Guatemala is working to develop a country-specific version of the AMI SOD for vector surveillance and control. The CDC is providing additional support to partners in Guatemala in developing PCR assays to detect knockdown resistance mutations (KDR) in four new world *Anopheles* mosquitoes, which is one of the mechanisms of resistance against dichlorodiphenyltrichloroethane (DDT) and pyrethroid-based insecticides.

The CDC and PAHO/WHO have been supporting Honduras and Brazil's NMCPs on the characterization of insecticide resistance mechanisms. In Brazil, the CDC has supported data analysis and interpretation. In Nicaragua, data collection for an ITN evaluation has been completed. PAHO has provided further assistance on training activities based on the AMI/RAVREDA strategy and country work plans, including site visits to Colombia in April–May 2015 and to Belize in June–July 2015.

## FY2015 Highlights

- Data from Peru was published in *Malaria Journal* in February 2015: “Novel Mutations on the ace-1 gene of the malaria vector *Anopheles albimanus* provide evidence for balancing selection in an area of high insecticide resistance in Peru.”
- A Guatemala study on LLINs was completed and data analysis got underway.
- PAHO/WHO and the CDC held a coordination meeting in November 2014 to improve and facilitate technical assistance to partner countries.

## Implementation Challenges

Within the LAC region, the use of evidence-based decision-making for vector control is not yet commonplace in public policy. Significant knowledge gaps exist and difficulties in disseminating research findings hinder officials’ ability to make evidence-based vector control decisions. In addition, the region has limited tools available for vector control, and of those in use, many uncertainties remain as to their acceptability and impact among target populations, especially with regard to the vector behavior and biting patterns that may impact the effectiveness of IRS and LLINs.

Outbreaks as a result of other vector-borne diseases including Dengue, Chikungunya, and Zika continue to weigh on countries’ vector control programs, resulting in a shift of resources and personnel away from malaria-specific vector surveillance and control. Countries should use an integrated approach to address these emerging and ongoing threats.

Although countries have strengthened their capacity to conduct routine insecticide resistance surveillance, their ability to manage insecticide resistance remains limited. The development and implementation of an SOP for insecticide resistance management is vital and should be prioritized for the coming year, so that countries have an established strategy for managing this threat.



Photo: PAHO/WHO

## 2.5 COMMUNICATION AND INFORMATION DISSEMINATION

Communication, information dissemination, and advocacy play a pivotal role in the continuation of efforts for malaria prevention and control. As malaria incidence decreases throughout the region, communication and advocacy efforts are required to take on a more targeted approach to malaria elimination, addressing the most at risk populations to ensure that there is not a rollback of achievements. These efforts are crucial to advance actions towards elimination by keeping malaria on the agendas of policy-makers, key stakeholders, and the public as a critical issue that impacts multiple segments of society.

Effective communication and information dissemination rely on parallel efforts to reach target audiences at the regional, national, decentralized, and community levels. In FY 2015 AMI partners PAHO/WHO and Links Media supported the development, adoption, and implementation of communication tools designed to inform policies for efficient and sustainable interventions to prevent, control, and eliminate malaria in LAC.

AMI communication partner Links Media: 1) conducted a rigorous assessment of the information and communication needs of 11 NMCPs and their various audiences, environmental factors, and specific policy requirements; 2) conceptualized and crafted realistic strategies for malaria communication and advocacy to address multiple audiences and consider the current epidemiological context of each country and specific areas of disease; 3) obtained strategy reviews and input from key stakeholders at the national and international levels; 4) harmonized communication strategies to ensure that they complemented existing country and regional strategies and plans of action; 5) created a robust portfolio of tools and documents to support the mobilization of resources for implementation of the malaria communication strategies; 6) helped to link NMCPs, MOHs, the donor community, mass media, and other key stakeholders with communication resources and local entities that could help them; 7) provided targeted technical assistance to NMCPs to enhance their capacity to communicate with their constituents and advocate for better malaria control with stakeholders; 8) fostered regional discussion and knowledge exchange on improved approaches for effective malaria prevention and control action with remote/rural, mobile/migrant, and indigenous populations; and 9) informed the regional consultation to develop a new *Strategy and Plan of Action for Malaria in the Americas: 2016–2020* to ensure strategic interventions in advocacy, communication, and knowledge dissemination.

### Communication Strategy Development

In FY 2015 Links Media collaborated with the NMCPs of Brazil, Colombia, Guyana, Ecuador, Peru, and Suriname to develop national communication strategies for malaria, and together with Belize, Guatemala, Honduras, Nicaragua, and Panama designed a regional strategy for the bloc of Central American countries. All strategies were designed to support NMCPs to systematically use a range of communication approaches to ensure the durability of technical, operational, and financial support from relevant stakeholders in the context of declining cases and deaths due to malaria. Brazil, Colombia, Guatemala, Guyana, Panama, Peru, and Suriname received ongoing technical assistance from Links Media during FY 2015 and FY 2016 to plan and implement previously developed communication interventions.

Specifically, the *Strategic Communication Guide for Malaria in Central America* aims to facilitate the mobilization of resources from MOHs, the donor community, and private funding sources to support the sustained functioning of malaria control programs for years to come. The document has served as an innovative roadmap for countries in the region to synchronize their communication efforts, and was used as a reference by other actors preparing for malaria elimination in the Asia-Pacific region.

## Forums for Coordination and Communication

PAHO/WHO and Links Media have established in-person and virtual communication forums to enhance and improve the frequency of interactions between AMI/RAVREDA network partners. In order to facilitate better coordination and establish a common understanding among actors and stakeholders, AMI has supported semi-annual Steering Committee meetings, a regional malaria partners meeting, annual AMI/RAVREDA evaluation meetings, the use of digital media, social networks, electronic correspondence, webinars, and quarterly bulletins. The AMI quarterly activities bulletins produced by Links Media highlight partner progress and have been shared with a wide audience in the region to enhance coordination.

Virtual forums play an important role in sustaining communication and information exchange among AMI partners throughout the year. Links Media continued to manage the AMI website ([usaidami.org](http://usaidami.org)) and social media platforms including Twitter, Facebook, Instagram, and LinkedIn in FY 2015. The AMI website in English, Spanish, and Portuguese serves as a repository for publications across technical interventions. Its “Resources” page also serves as a knowledge management tool for products developed by AMI-supported countries themselves; Colombia’s MSPS provided GFATM Project Malaria Colombia materials for upload to the site to aid in the transition process following project close-out. Digital engagement by malaria stakeholders from the region and the world increased on all platforms, as evidenced by growth in interactions, followers, and unique users that visited these communication channels.

## Technical Assistance for Implementation of Communication Approaches, Including Targeted Interventions for Key Populations

Key populations are defined as groups that experience a higher epidemiological incidence, risk, or burden of disease, combined with significantly lower access to services, at the same time that they belong to a criminalized or marginalized sub-population.<sup>24</sup> These populations are considered more vulnerable to malaria infection in certain situations or contexts, as is the case with itinerant miners, loggers, remote and mobile populations, and indigenous peoples. AMI partners have previously referred to these key populations as living in “special circumstances,” and have acknowledged that differentiated communication approaches are required to reach them with messages about malaria prevention and control.

From 2015–2016 Links Media advised the Guyana’s NMCP, known as vector control services (VCS), to develop multi-channel communications about malaria prevention and case management. Formats included a billboard, social media, and multi-lingual Information, Education and Communication (IEC) self-instructional materials on RDTs for use by the mobile mining and logging populations.

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<sup>24</sup> Ibid 2.

In FY 2015, Peru's Loreto Region experienced a resurgence of malaria that resulted in the declaration of a health emergency. AMI technical partners including Links Media traveled to the city of Iquitos in March 2015 to provide technical assistance on the planning of key interventions in response to the emergency. During subsequent capacity building and training, special attention was provided to this region, where disease incidence is highest in Peru. The communication strategy developed for malaria in Peru focused on Loreto, and included recommendations for working with indigenous populations and improving the coordination and communication between national and local-level health actors. In all, the Peruvian MOH trained 371 community health workers on best practices for malaria control in Loreto, including 105 indigenous health workers.<sup>24</sup>

Following the conclusion of a five-year GFATM grant in early 2015, the Colombia's MSPS sought to urge the continuation of community-level efforts at the decentralized level in order to prevent the resurgence of malaria. The grant funded Project Malaria Colombia, and supported five malaria-endemic departments on the country's Pacific Coast, and included the use of communication and social mobilization to raise community awareness and promote healthy behaviors conducive to malaria prevention and control. With support from Links Media, the MSPS drafted a policy paper calling on decentralized authorities to sustain behavior change communication and social mobilization efforts by dedicating sufficient departmental and municipal health resources to community-level activities.

Also during FY 2015, Brazil's NMCP initiated the development of a national social mobilization strategy to address gaps in population coverage with continuous prevention, diagnosis, and treatment services. Malaria endemic states in Brazil and Links Media provided input to Brazil's NMCP on communication interventions that could help address high malaria incidence among itinerant gold miners (*garimpeiros*), riverside communities, and indigenous populations in the Amazon region. Links Media provided guidance and recommendations for working with vulnerable groups in a technical assistance document that was delivered in June 2015.

In Suriname, Links Media provided research and recommendations for letters that were drafted to the president, vice president, and cabinet members on the topic of malaria. The letter requested additional support for the Ministry of Public Health's Malaria Program goal of reaching malaria elimination by 2020, as a measure to help prevent the emergence of artemisinin resistance.

## Dissemination of the Evidence Base

Links Media and PAHO/WHO have worked with other implementing partners to collect, summarize, and disseminate technical guidance and operational research findings that help to inform national decision-makers and managers of malaria control strategies. Originally published in Spanish in 2011, SODs on the topics of vector surveillance and control, the management of pharmaceuticals and supplies for malaria, and antimalarial resistance and efficacy monitoring were made available in English and Portuguese through collaboration between PAHO/WHO and Links Media.

Dissemination of scientific studies is done continuously through the virtual communication channels mentioned above, as well as with targeted communication activities such as an annual Malaria Day in the Americas forum. The celebration of Malaria Day in the Americas serves as an additional platform for reaching decision-makers. PAHO/WHO collaborates with partners outside of AMI to highlight successes and needs within the region

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<sup>24</sup> Indigenous health workers who were trained in Peru were of the Bora, Cocamas, Cocamilla, Ikitu, Quichoa, Ticunas, Urarinas, and Yaguas ethnicities.

and recognizes three Malaria Champions of the Americas each year, which normally include key programs and interventions that have resulted in decreased malaria incidence. Links Media supported the 2014 and 2015 celebrations by providing guidance on social media outreach and coordinating efforts with USAID social media channels such as the USAID Global Health and President's Malaria Initiative (PMI) accounts, as well as documenting social media engagement.<sup>26</sup>

In addition, Links Media has conducted media outreach to highlight new research and noteworthy events related to malaria in LAC. A news release issued in November 2014 alerted stakeholders to a budding regional partnership for the provision of technical assistance on medicine quality following a workshop that USP/PQM organized with AMI support. For World Malaria Day in April 2015, Links Media promoted news releases about malaria in pregnancy and PAHO's call for nominations for the next Malaria Champions of the Americas. In June 2015, Links Media placed an article in the Spanish-language edition of [SciDev.net](#) about findings of Peruvian health officials, NAMRU-6, and the CDC related to the effective management of malaria outbreaks.

Communication, information dissemination, and advocacy will play an even larger role in educating malaria actors and stakeholders about important definitions and requirements for malaria elimination going forward. To that end, AMI has supported the development of fact sheets summarizing PAHO/WHO technical guidance including Frequently Asked Questions (FAQs) on Malaria Elimination, a list of selected resources for malaria elimination, and a series of fact sheets for interventions in low-incidence settings. Links Media has designed these communication tools in multiple languages for use by NMCPs and malaria advocates in the region.

## FY2015 Highlights

- Brazil's NMCP initiated the development of a national social mobilization and participation strategy for malaria control in collaboration with decentralized authorities and numerous other government ministries during a workshop with decentralized staff in October 2015.
- Guyana's NMCP worked with the Gold and Diamond Miners Association to prepare for RDT roll-out in Regions 7 and 8, and reached out to the Ministry of Indigenous People's Affairs to request the inclusion of malaria on the agenda during Indigenous Heritage Month festivities.
- Following a field validation, Links Media and MSH/SIAPS collaborated on the adaptation of illustrated job aids for a range of audiences in Guatemala, from regional managers to voluntary collaborators, on the topics of diagnosis, treatment, pharmaceutical management and malaria case management.
- Malaria communication strategies were presented for Peru, Suriname, and the Central America region.
- Malaria research conducted by Peru's NMCP, US NAMRU-6, and the CDC was disseminated via a Spanish-language article on [SciDev.Net](#).
- Colombia's MSPS received Links Media's support to draft a policy paper for decentralized decision-makers in order to improve local ownership of communication and social mobilization efforts related to malaria at the community level.
- Letter about malaria elimination to national-decision makers in Suriname was drafted with Links Media's input, with the goal of mobilizing additional support for malaria elimination as a means of preventing the emergence of artemisinin resistance.

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<sup>26</sup> See: <https://storify.com/AmazonMalaria/malaria-day-in-the-americas>

## Implementation Challenges

Limited budgets and personnel with which to implement communication interventions have prevented many NMCPs from conducting strategic planning for malaria communication. Links Media and other AMI partners have encouraged NMCPs to, besides planning and budgeting for communications, aim to overcome the lack of resources by pursuing partnerships outside the health sector and from private industry groups, based on mutual interests in achieving malaria control. Countries will have a continuing need for capacity building and TA in communication in the coming years, in order to implement the malaria communication strategies that they developed with Links Media's technical support.

NMCPs and/or MOHs need to designate appropriate liaisons to carry communication strategy implementation forward. Having a communication liaison for malaria is vital for sustainability as well as to help keep malaria on the public policy agenda. Countries that lack a specific liaison for communication and advocacy related to malaria are at a disadvantage when it comes to strategy development and implementation, as well as in conducting outreach and building alliances with non-traditional partners.

Moreover, country partners continue to face difficulties in working with key populations including rural, indigenous, mobile and migrant workers that often experience a greater share of the disease burden. National malaria strategies must account for these populations and plan to work with social scientists on tailored communication interventions to reach them.

Finally, the demand exists for more in-language communication products on malaria prevention, control, and elimination. Links Media has placed an emphasis on providing communication tools in Spanish and Portuguese to help NMCPs reach decision-makers with timely, useful information about malaria. It has been helpful to translate important documents and research findings, or summaries of the same, in order to share and apply best practices locally.



Photo: PAHO/WHO

## 2.6 REGIONAL NETWORKING AND SYSTEMS STRENGTHENING

AMI benefits countries by addressing shared problems through a coordinated regional approach that allows for the comparison of operational research and monitoring of results across countries. AMI/RAVREDA is distinguished from other malaria initiatives by the regional collaboration, coordination, and sharing of lessons learned that take place among countries. Countries in the LAC region take advantage of AMI/RAVREDA as a regional mechanism to jointly develop capacity related to the technical areas of antimalarial resistance monitoring, diagnosis, treatment, vector control, disease surveillance, and communication. Partners maintain an ongoing exchange of information and expertise through South–South collaboration.

### **Cross-border collaboration between Colombia and Panama**

AMI partner PAHO/WHO has identified the need for regional and cross-country collaboration with specific attention to border areas in the design of surveillance systems. Stemming from this need, Panama has initiated activities and strengthened cooperation with Colombia through interventions in the shared border, where access to health services is challenging and costly for affected populations. During FY 2015, national authorities of both countries signed a cross-border cooperation agreement. Between July–September 2015, Panama and Colombia held a cross-border training workshop on operational protocols for malaria surveillance for 24 personnel working in border areas. Colombia's and Panama's MOH personnel discussed malaria surveillance along the border and facilitated joint training exercises, one of which was an exchange program for Panamanian entomologists to receive instruction with their Colombian counterparts. Plans exist to continue this bi-national collaboration.

### **USP/PQM workshop on sustainable regional collaborations for medicine quality**

During FY 2015, USP/PQM coordinated a regional workshop in Lima, Peru that was attended by officials from MRAs, OMCLs, and selected schools of pharmacy from 16 LAC countries. The workshop served as a forum to explore possible sustainable mechanisms to implement South–South collaboration for the quality assurance of medicines. Subsequently, selected country representatives collaborated with PQM and PAHO in writing a concept note to countries' ministers of health. USP/PQM disseminated the concept note with conclusions and recommendations from the workshop, in addition to surveillance information on capabilities and needs of countries' MRAs and OMCLs. Existing resources that could contribute to the provision of South–South TA were highlighted.

### **Malaria Partners Meeting and AMI/RAVREDA Annual Evaluation Meeting**

From March 23–27, 2015, AMI/RAVREDA technical partners, country officials, and representatives of other malaria initiatives in the region convened in Rio de Janeiro, Brazil for a Malaria Partners Meeting and AMI/RAVREDA Annual Evaluation Meeting. The meetings provided an opportunity for participants to share lessons learned, results, and best practices to help countries within the region improve control and move towards elimination. Major themes included guaranteeing access to prompt, quality diagnosis and treatment in light of the reduced number of cases, the threat of antimalarial drug resistance, the quality of essential medicines, and vector surveillance and control.

The Malaria Partners Meeting allowed for knowledge sharing among multiple malaria initiatives, technical partners, and country-level actors such as representatives of MOHs and NMCPs. This meeting sought to undertake malaria prevention, control, and elimination in a more coordinated and effective manner, as well as to identify a mechanism for better coordination of all relevant stakeholders within the region. The meeting catalyzed efforts within LAC to form a Technical Advisory Group (TAG) with the objective of bringing together experts to provide guidance on regional malaria control and elimination efforts, and help validate a new multi-year strategy for the region.

### **Regional Malaria Leadership Course**

From September 21–October 2, 2015, AMI supported the participation of partners from Belize, Brazil, Honduras, Nicaragua, Panama, Peru, USAID, PAHO/WHO, and Links Media in the regional edition of the “Science of Eradication: Malaria” course in São Paulo, Brazil. The course was administered to approximately 100 program managers and members of the research community in malaria-endemic countries. It was hosted at the University of São Paulo’s School of Public Health and co-sponsored by the Harvard T.H. Chan School of Public Health, the Swiss Tropical and Public Health Institute (Swiss TPH), and the Barcelona Institute for Global Health (ISGlobal), with logistical and financial support from PAHO/WHO under AMI, the São Paulo Research Foundation (FAPESP, by its Portuguese acronym), the Bill & Melinda Gates Foundation, and the Coordination for the Improvement of Higher Education Personnel Foundation (CAPES, by its Portuguese acronym).

### **Regional Bulletin on Imported Malaria Cases**

Brazil’s NMCP has developed a regional bulletin on malaria cases imported from the following neighboring countries: Bolivia, Colombia, Peru, Guyana, French Guiana, Suriname and Venezuela. The bulletin provides an analysis of the number of cases disaggregated by sex, age, parasite species, and occupational activity of infected individuals. It has been updated monthly and circulated among all countries that border Brazil. AMI partners encourage other countries in the region to develop and disseminate similar bulletins on the origin and number of imported malaria cases by country, following the Brazilian model.

Photo: William Miller



# CONCLUSION— CHALLENGES AND OPPORTUNITIES

## Chapter 3



Photo: PAHO/WHO

## 3.1 CHALLENGES, NEEDS AND OPPORTUNITIES

Even in the context of significantly reduced malaria cases and mortality, improved prevention and control practices, wider availability of diagnosis and quality-assured medicines, increased surveillance, and regional collaboration, a number of challenges remain for the LAC region. In the path towards malaria elimination, maintaining the gains and continuing to improve in terms of capacities to detect and manage malaria is of paramount importance. Paradoxically, in spite of the long-standing commitment of LAC governments to combat malaria, many NMCPs have experienced ongoing instability of human, financial, and other material resources.

In addition, important factors that threaten the gains made to date are:

- Deficiencies or delays in reporting to national surveillance systems
- Health system reorganization and decentralization
- Loss of capacity to perform laboratory diagnosis of malaria and manage cases
- Remote and disenfranchised status of affected populations, leading to neglect
- Competing priorities due to emerging diseases such as Zika and Chikungunya, as well as epidemics of well-established diseases like Dengue
- Achievement of higher-income status in the region, together with a decreasing burden of disease, which may cause some countries to lose their eligibility to receive external financing from GFATM, USAID, or other donors
- Emergence of new types of antimalarial drug resistance, as a result of constant parasite mutations and mobility of both human and parasite populations
- Mosquitoes' development of resistance to available insecticides, and/or changes in anopheline behavior in response to insecticides
- Reintroduction of malaria from outside the LAC region to areas that remain receptive
- Disengagement of affected populations, leading to under-utilization of available prevention measures (IRS and LLINs), diagnosis, and treatment services offered by the public sector

As the LAC region moves towards malaria elimination, greater emphasis must be placed on continued regional coordination and collaboration among countries. Population, vector, and parasite mobility patterns between countries will need to be monitored and addressed through country-supported collaboration mechanisms like RAVREDA. Regional networks will remain relevant in order to sustain the gains and avoid backsliding. Moreover, regional networks for malaria may even play a more significant role in improving communication, bringing multiple partners and stakeholders together to enhance collaboration, share epidemiological information, mobilize additional resources, and achieve sustainable actions in the long term.

Diagnosis and treatment of cases are fundamental malaria control interventions. However, some areas within endemic countries have limited diagnostic capabilities due to lack of resources or lack of trained microscopists. The use of RDTs can provide a stopgap solution, but availability and reliability of RDTs vary, especially in light of

recent research regarding HRP2 and HRP3 gene deletion in *P. falciparum* parasite strains in the region. As a result, surveillance systems may not be able to capture all infections, which taken together with asymptomatic cases, poses a challenge to prevention and control efforts in the region. Another challenge related to ensuring reliable disease surveillance is the need to improve information sharing with private health service providers, which must provide laboratory confirmation and notification of 100% of the malaria cases detected to the public sector in order to achieve elimination.

With regard to treatment, recent studies have shown no artemisinin resistance in the Americas, but the possibility for it to emerge remains a concern. In observing the impact of artemisinin resistance in Southeast Asia, the possible consequences in South America could negate significant advances made in malaria control, as most countries rely on an ACT to treat *P. falciparum* infections as their essential tool. Countries must continue to promote the proper treatment of confirmed cases, while also monitoring for delayed parasite clearance in infected patients.

In order to treat all cases, countries need to ensure that they maintain minimum stock levels of antimalarial medicines at both the central and decentralized levels. As noted above, this may be difficult, as pharmaceutical companies lack a financial incentive to supply essential medicines in the small quantities that are needed. Countries should continue to monitor, track, and report on their inventories of medicines to foresee possible shortages, prevent stock-outs, and identify and resolve issues in the pharmaceutical supply chain.

The threat of poor quality and counterfeit drugs to malaria prevention and control efforts is well known, and a country's ability to address this issue is essential. The region has made strides in its ability to ensure medicine quality as countries have strengthened their regulatory capabilities. Collectively, the region has excellent laboratory capacity to perform compendial tests and other key functions. However, as of 2014 no single country in the LAC region was fully able to address all facets of medicine quality within its health system. Instead, countries must work together or forge partnerships with local universities to address gaps in capacity and implement routine testing of antimalarial medicines.

In the area of vector surveillance and control, insecticide resistance management poses a challenge to controlling mosquito populations, in addition to shifting to address other vector-borne diseases such as Dengue, Chikungunya, and Zika. Field entomologists have been trained to monitor and detect insecticide resistance, however managing and responding to resistance at the national level can vary between countries. SOPs to manage insecticide resistance need to be developed to guide program managers in the region. An additional gap is that only a limited number of insecticides can be used to control *Anopheles* mosquitoes; few new insecticides have been produced for public health purposes in the last 30 years.

Communication and information dissemination are valued by program managers in the region, however NMCPs require greater commitment and resources both human and financial to reach affected communities and policy-makers in order to mobilize more resources for malaria. Malaria diagnosis, treatment, and vector control must include Social and Behavior Change Communication (SBCC) and health promotion interventions, as well as advocacy and stakeholder outreach in order to be more effective. Inter- and intra-agency coordination and collaboration across different sectors of the economy need to be articulated through effective strategic communication. A lack of commitment to strengthen and invest in communication as a component of the strategy against malaria will greatly constrain MOHs' and NMCPs' progress against malaria. Resources for malaria control and elimination risk to be reduced over time if NMCPs fail to engage at the policy level to educate leaders about the need for sustained investment. Communication should be assumed as a line of work of its own, with concrete objectives and measurable indicators in alignment with the overall goals of AMI/RAVREDA.

## 3.2 BEST PRACTICES TO BE EXPANDED OR REPLICATED

### Multi-sectoral engagement

Partnering with private infrastructure projects in the Amazon to mitigate malaria transmission is a model from Brazil that may serve as an example to other countries with the potential for increased malaria due to economic development projects. In Brazil, since 2006–2007 companies building hydroelectric dams in malaria-endemic states have been required to develop and execute malaria control plans as part of their environmental licensing requirements.<sup>27</sup> In the example of the Santo Antônio and Jirau hydroelectric dams built in Rondônia state, an investment totaling more than \$12 million was made by builders and malaria control activities were executed by the Porto Velho Municipal Health Secretariat. Now that the dams are operational, the communication and coordination between the MOH and the Ministry of the Environment for engaging the private sector have led to a significant reduction in malaria cases. The same policy model could be employed elsewhere by way of using cross-sector collaboration to leverage novel sources of funding to address priority areas for malaria control.

### Systematic monitoring of HRP2/HRP3 gene deletion

Progress has been made with the selection and introduction of RDTs, thanks in part to USAID's support for a systematic survey of HRP2 and HRP3 gene deletion patterns in the Americas. Now that a regional baseline exists, countries' NMCPs should monitor the prevalence of HRP2 gene deletion at three-year intervals due to the possibility for spontaneous genetic mutations and the migration of parasites over time. Molecular surveillance of parasite populations should be a routine activity in countries throughout LAC, in order to observe and respond to trends in constantly evolving malaria parasites. Accurate diagnosis of all cases depends on the ability to gather and interpret this data.

### Regional collaboration to strengthen the Three Level Approach

The Three Level Approach to medicine quality control is cost-effective, fast, and a reliable methodology for executing antimalarial quality control tests in malaria-endemic regions. It consists of sequential and complementary levels of quality control of increased complexity. The Three Level Approach has been adopted in Peru and Colombia; a regional workshop sponsored by AMI in FY 2015 resulted in a concept paper on how to build capacity regionally using South–South collaboration and promote its formal adoption to strengthen other countries' national pharmaceutical quality control systems. One of the key factors has been the involvement of universities in antimalarial medicine QA/QC, as evidenced by Peru and Brazil's recent partnerships with universities. Other countries could examine university laboratory capacity for similar collaborations.

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<sup>27</sup> Per Brazilian Ministry of Health Regulation N° 001 in 2014 and Inter-Ministerial Regulation N° 60 in 2015, following the issuance of Regulation N° 47 in 2006.

## Good pharmaceutical supply management practices at primary level health facilities

AMI partner MSH/SIAPS has developed best-practice guidelines for the management, storage, and supply of malaria pharmaceuticals for primary health facilities. As of FY 2014, Brazil and Ecuador were using the best-practice guidelines fully, according to preliminary results of a regional assessment. Colombia and Guatemala have piloted the guidelines with local-level staff in specific areas with elevated malaria transmission to positive outcomes, but have not yet extended the pharmaceutical management practices to other areas beyond the pilot sites.

## Quality assurance network for microscopy diagnosis

National laboratories in Honduras and Peru have a strong role in the network supporting quality assurance of malaria microscopy in AMI-supported and other countries in the Americas. The regional EQAP has been made possible in part by their leadership. A slide bank was developed in Honduras with microscopy blood slides that can serve as a resource for training and the maintenance of national capacity throughout the region. Meanwhile, external quality assurance methods still need to be implemented at the decentralized level in many countries in the LAC region.

## Targeted actions with remote/rural, mobile, and indigenous populations

Key populations have been reached with success in a few cases, but little has been done to scale up or replicate these isolated positive experiences. Mobile populations in mining areas have been reached with SBCC efforts in parts of Brazil, Guyana, and Suriname, and migrant sugarcane workers have benefited from private sector cooperation in Guatemala. Differentiated health services have been provided in the indigenous communities of Bisira, Panama, Wampusirpi, Honduras, the Alto Rio Solimões indigenous health district in Amazonas state, Brazil, and in the department of Alta Verapaz, Guatemala. Examples that have been identified should be shared and lessons learned should be applied more widely across the region. The sharing of successful experiences for adaptation elsewhere is increasingly feasible at a low cost, given the proliferation of information and communication technologies for virtual collaboration.



Photo: PAHO/WHO

## 3.3 FUTURE DIRECTIONS

The coming years will be pivotal to implement a strategy for the sustainability of malaria prevention, control, and elimination efforts in the LAC region. As they move towards elimination and beyond, countries will need to have sustained capacities to: detect and manage malaria, particularly among key populations; detect and contain malaria re-emergence and re-introduction; monitor and—eventually—address resistance to antimalarials; implement, monitor and evaluate vector control interventions; effectively use communications; and continuously improve program performance in a decentralized health sector. Needless to say, countries also need to continue to build on previous efforts, using new evidence and incorporating new tools and approaches, as they become available, to strengthen their programs.

The regional network, RAVREDA, must be expanded to include all countries that are stakeholders in malaria elimination, and should serve as a reference for all donors and agencies interested in supporting malaria elimination in the region, while the national malaria strategic plans are considered the guidance for country level cooperation.

By the end of 2016, the next iteration of the *Strategy and Plan of Action for Malaria in the Americas 2016–2020* will be finalized and approved by the 55th Directing Council of PAHO. This document will outline the key interventions for the LAC region following the WHO's *Global Technical Strategy* and *AIM* documents, which were released in 2015 and reflect a reorientation of efforts towards elimination. To achieve elimination in the region, AMI partners will need to ensure that good practices for prevention and control are leveraged and sustained past the goalpost of zero incidence.



Photo: William Miller

# COUNTRY PROFILES AND COUNTRY CONTEXT

## Appendix I



Photo: PAHO/WHO



## BELIZE

Belize has surpassed the MDG 6 objective and is currently moving towards elimination. The country has experienced a dramatic decline in malaria cases, reporting reductions of over 95% since 2000. Residual and active areas of disease transmission are primarily found in the southern state of Stann Creek; however, a recent resurgence of malaria cases has been identified in northern Belize.

Malaria transmission occurs from February to April during the dry season, and from August to October during the rainy season. The majority of cases are *P. vivax* infections. Both *P. falciparum* and *P. vivax* infections are treated with CQ and PQ. In 2013 and 2014, patients reportedly received treatment more than 72 hours after onset of symptoms.

The primary malaria control strategy in Belize has been IRS. In recent years, the country has also implemented ITNs, and has prioritized larval control, surveillance, cross-border collaboration, and timely diagnosis and treatment of malaria cases.

Belize has come to focus on improving the accuracy of malaria diagnosis, strengthening surveillance and conducting joint trainings on the proper use of diagnostics with Mexico, with support from AMI. As a result of the recent resurgence of cases in the north, Belize aims to expand its national diagnosis network to the northern part of the country. The country has also updated its national treatment guidelines, with technical support from PAHO/WHO. The country's new national treatment guidelines have incorporated ACTs for *P. falciparum* cases and encompass other strategic areas including surveillance and case follow-up. Additional measures to prevent imported cases include the distribution of ITNs to travelers going to areas with reported CQ resistance, and screening them upon their return.

Given the limited number of antimalarials procured for the country, Belize has conducted periodic quality control tests on randomly selected antimalarial drugs with support from PAHO/WHO.

In 2015, Belize completed an analysis of vector behavior and distributed a new manual on IVM for community health workers and voluntary collaborators. This manual will make it possible to formulate evidence-based interventions and target them to geographic areas that are particularly at-risk.



## BRAZIL

Although malaria continues to be a major public health problem in Brazil, the country has made significant progress in reducing malaria incidence and mortality and had officially met the MDG 6 target of reducing the malaria burden by 75% as of 2014. That same year, the country also reported its lowest number of malaria cases in 35 years.

Established in 2003, Brazil's NMCP's aim is to reduce mortality from malaria, reduce severe cases, reduce the incidence of the disease and interrupt transmission. The country's NMCP is part of the MOH's Department of Health Surveillance, and collaborates with the ministry's Community Health Outreach Programs and Family Health Strategy.

Malaria transmission in Brazil is present throughout the year and is seen to be highest during both the dry season and the peak of the rainy season, April–May. With the vast majority of malaria concentrated in the Amazon region of Brazil (99.8%), the Brazil's NMCP has concentrated its efforts on endemic states in that region. The primary vector in the Amazon region is *An. darlingi*. In 2014, 82.9% of all cases were caused by *P. vivax*, while *P. falciparum* caused only 15.6% of cases, and <2% were caused by other species and mixed infections. Microscopy is the main method for diagnosing malaria in the country. In the Amazon region, first line treatment for *P. vivax* infections is CQ and PQ, while *P. falciparum* infections are treated with artemether-lumefantrine and artesunate-mefloquine.

Between 2013 and 2014, malaria cases among gold miners decreased by 47% and loggers decreased by 19%. Malaria also disproportionately affects indigenous populations and plantation workers, especially in the states of Amazonas and Roraima. Despite the high number of laboratories in the state of Amazonas, only half of their patients were treated in less than 48 hours.

In FY 2015, Brazil worked to make its approach to improving and sustaining malaria prevention, diagnosis, and treatment services more inclusive by specifically targeting key populations in malaria endemic states (pregnant women, itinerant gold miners, migrant workers, and indigenous and riverside populations) with differentiated communication and social mobilization strategies. The country most recently focused its efforts on distributing LLINs as a method of vector control, and established sentinel sites in remote parts of the country to complement antimalarial resistance surveillance efforts.

The country's nine malaria-endemic states have been executing strategies to close the gaps for adequate implementation of standard malaria control

interventions. Diagnosis units have been established in remote locations of the country and will have personnel trained to diagnose patients with RDTs. Brazil has worked to ensure that its network of 4,900 laboratory technicians, including in the Amazon region and other regions of the country, maintain their capacity for malaria diagnosis. To reduce the country's annual deaths attributed to malaria, Brazil has adjusted its surveillance system to incorporate the reporting of malaria outbreaks, which will allow for an immediate response. The country has also increased efforts to eliminating *P. falciparum* malaria and recently launched a National Elimination Plan with the goal of reducing cases by 90% by the year 2030. The elimination plan provides important technical guidance for Brazilian municipalities, and defines differentiated strategies for diagnosis, treatment, vector control, health education and social mobilization. In November 2015, the country's NMCP was recognized as the 2015 Malaria Champion of the Americas.



## COLOMBIA

Colombia reported a 71.8% decrease in malaria cases between 2000 and 2014. Despite being the second country with the largest number of malaria-related deaths in the region overall, mortality has decreased by 86.3% since 2000 and the country is on track to meet the MDG 6 objective by 2015.

Malaria transmission in Colombia is concentrated in the northwestern region of the country, near the Panamanian border. The months of March–June are the peak transmission period. Although the majority of malaria cases in Colombia occur in rural areas, the Colombian Pacific coast has been reporting increasing urban and peri-urban malaria transmission.

Various vector species exist in Colombia, including *An. darlingi*, *An. psuedopunctipennis*, *An. albimanus*, *An. nuneztovari*, *An. neivai*, and *An. punctimacula*. The majority of cases have been due to *P. vivax*, although in 2014 the country reported an increase in *P. falciparum* infections. Microscopy is the most common method to diagnose malaria in the country, however RDTs are also used. The first line treatment for *P. vivax* infections is CQ and PQ, while *P. falciparum* infections are treated with artemether–lumefantrine. In 2014, only 36% of all malaria patients waited more than 72 hours before receiving treatment.

Colombia hosts regular roundtable meetings composed of experts and stakeholders from the country's universities, research centers, and public health authorities. During these meetings, new data from antimalarial efficacy and resistance monitoring is reviewed and policy recommendations are made.

Colombia's experience certifying and training operational technicians and entomologists continues to serve as a model for South–South cooperation. During FY 2015, the country strengthened cross-border cooperation with Panama in a variety of areas, including insecticide resistance surveillance and monitoring the efficacy of prescribed antimalarial drugs along the border with Panama. A new sentinel site in Chocó is one component of a binational project with Panama.

During FY 2015, the country's OMCLs participated in a training to support the development and validation of new analytical methods for medicines not currently included in the Minilabs™. Colombia developed pharmaceutical supply management criteria for low-incidence areas and a system for tracking stock availabilities.

Colombia's NMCP collaborated with USAID-funded MSH/SIAPS to develop the first draft of a research protocol to estimate the under-reporting of malaria cases at diagnosis and treatment posts in high-burden departments in Colombia. In an effort to ensure quality diagnosis for all patients, Colombia's recently developed *Manual on Malaria Diagnosis Quality Assurance in Colombia* is being adapted to international guidelines.

## ECUADOR



Ecuador has surpassed the MDG 6 objective and is currently in the pre-elimination phase. Between 2013 and 2014, the country reported a decrease of locally transmitted cases, from 544 to 368. As part of the country's health system reorganization, the Ministry of Public Health (MSP, by its Spanish acronym) has absorbed Ecuador's National Control Service for Vector-Borne Diseases (SNEM, by its Spanish acronym).

Ecuador's malaria transmission differs in the Eastern and Western regions of the country. While the Eastern region experiences malaria transmission during the rainy season (October–May), the Western region experiences transmission year-round. The vector control methods used in Ecuador are IRS and the distribution of ITN's.

The most common vector in the Amazonian area is *An. darlingi*, while *An. albimanus* is found on the Pacific coast. *P. vivax* is the main malaria-causing species; however the country also reports *P. falciparum* infections. The first line treatment for *P. vivax* infections is CQ and PQ, while *P. falciparum* infections are treated with artemether-lumefantrine. As of 2013, 83.1% of patients diagnosed with malaria were treated within 24 hours of the onset of symptoms.

Ecuadorian and Colombian national counterparts have initiated discussions to coordinate joint trainings for the improvement of surveillance on the border. As a result, Ecuador has expanded its antimalarial surveillance to areas of disease transmission in San Lorenzo, with the implementation of a tool for following up on *P. falciparum* cases along the northern border between Colombia and Ecuador. In order to reduce the malaria burden in high-transmission areas and improve the country's allocation of resources to this effort, Ecuador integrated a malaria module into the country's epidemiological surveillance system.

Regarding the implementation of quality assured diagnosis, Ecuador created a network for the diagnosis of malaria using microscopy. This network has been integrated into the country's National Institute of Public Health Research (INSPI, by its Spanish acronym), through the National Reference Center for Parasitology (CNRP, by its Spanish acronym).

Improving antimalarial drug management has been a priority for Ecuador. With support from PAHO/WHO and the MSH/SIAPS program, antimalarial medicines are now part of the country's supply chain management system. To strengthen drug quality control, the medicines regulatory agency created in 2013, ARCSA, has included the Three Level Approach as one of its modalities for post-registration medicine quality monitoring. Consequently, ARCSA will now use Level 2 rapid analytical tests for pharmaceutical quality control.



## GUATEMALA

Over the past 15 years, Guatemala has reduced its malaria burden by over 75%. The country achieved the MDG 6 target in 2008. Most malaria cases are concentrated in the southern coastal departments of Escuintla, Retalhuleu, and Suchitepéquez. Transmission is perennial, mostly occurring between May and October. As of 2014, two adjacent municipalities in Escuintla, La Gomera and Masagua, accounted for 48% of all cases.

The Malaria Sub-Program of the Guatemala's MOH handles operational responsibilities for malaria control in the country, with support from technical officers for malaria in each department. In July 2015, the Malaria Sub-Program finalized the country's *National Malaria Strategic Plan 2016–2020*, providing strategic direction to efforts to achieve malaria elimination.

The main malaria vectors present in Guatemala are *An. darlingi*, *An. albimanus* and *An. pseudopunctipennis*. *P. vivax* is the predominant malaria-causing species, however *P. falciparum* infections are present as well. The country experiences high transmission during the dry season, from January to March, and experiences a constant migration of agricultural workers in and out of malaria-endemic areas; this has led to increased malaria importation into non-endemic areas.

Microscopy is the principal means of diagnosis, however RDTs are also used. CQ and PQ are used to treat both *P. falciparum* and *P. vivax* malaria, because there is no evidence of CQ resistance among locally transmitted parasite strains. Guatemala's vector control methods include use of ITNs, cleaning breeding sites, and engaging community members in vector control efforts.

Guatemala's malaria burden is highest among rural, indigenous populations such as the Q'eqchi Maya of Alta Verapaz, and among migrant agricultural workers. Under a national-level grant from the GFATM, the country has focused interventions on the mobilization of community volunteers to access, educate, and treat these high-risk populations. Guatemala's network of volunteer collaborators has received additional training and job aids to improve diagnosis, case management, and effective management of the antimalarial supply chain with support from AMI.

Additionally, Guatemala has obtained technical assistance from AMI to improve supply chain management, quality monitoring of drugs, and insecticide resistance. As part of an evaluation of the efficacy of insecticides approved for vector control interventions in the country, 28 individuals were trained, and field visits to Escuintla and Alta Verapaz were organized. During the field visits, test results indicated that mosquitoes in both areas remain susceptible.



## GUYANA

Between 2000 and 2014, annual malaria cases in Guyana decreased by 48.6% and deaths decreased by 62.1%. Despite these achievements, the country has yet to meet the MDG 6 target.

Malaria is endemic to the interior tropical rainforest regions of the country, including Regions 1 (Barima-Waini), 7 (Cuyuni-Mazruni), 8 (Potaro-Siparuni) and 9 (Upper Takutu-Upper Essequibo). Transmission rates are particularly high in the regions bordering Venezuela and Brazil. Regions 1, 7, and 8 are popular among migrant workers due to gold mining and logging opportunities, which present a challenge for the country's malaria control efforts. Indigenous groups that live near the country's mining areas are among the most affected by malaria. In 2014, indigenous people accounted for 37% of all reported cases, although they represented less than 10% of the country's population.

*An. darlingi* is the primary malaria vector found in Guyana. In 2014, 58.1% of all cases were caused by *P. vivax*, with the remainder being *P. falciparum*, other species, and mixed infections. First line treatment for *P. falciparum* is still the artemisinin combination artemether + lumefantrine. First line treatment for *P. vivax* is CQ and PQ. IRS and ITNs are used as vector control methods in the country.

Microscopy is the principal method of diagnosis in Guyana. In FY 2016, in order to ensure timely diagnosis where microscopy is currently unavailable, Guyana's VCS trained health professionals in priority regions for a field validation of RDTs prior to a pilot launch with support from GFATM. Regions 1, 7, and 8 have been identified as priority areas for the deployment of RDTs; training and other preparation for their roll-out have been supported through AMI by PAHO/WHO and Links Media.

The threat of antimalarial drug resistance is especially concerning to Guyana and other countries in the Guiana Shield sub-region of South America (Suriname, French Guiana, Brazil, and Venezuela). Results of efficacy trials in 2014 indicated that ACTs remain effective for the treatment of *P. falciparum* malaria in Guyana. Given these results, in FY 2015 the country updated its *National Malaria Strategic Plan* and has expressed a commitment to eliminating *P. falciparum* in the coming years.



## HONDURAS

Honduras has made significant progress in reducing malaria transmission since 2000, reporting a 78% decline in malaria cases between 2000 and 2015 and achieving the MDG 6 objective. The country is also working towards the regional goal of eliminating malaria by 2020, and is committed to reducing locally transmitted malaria cases by 45%, with zero new cases of *P. falciparum* by 2017.

Honduras' malaria program focuses on reducing transmission among key populations with greater epidemiological vulnerability to malaria. The Health Surveillance Unit works with communities to install LLINs, carry out surveillance, expand diagnostic coverage, and ensure access to treatment. Strong community involvement has resulted in successful malaria control and prevention interventions. The vast majority of malaria cases occur in the eastern part of the country, in difficult-to-reach, remote areas where the highest numbers of *P. falciparum* cases have been detected. Nonetheless, the country's Health Surveillance Unit has reduced malaria cases by an average of 56% in the six departments that account for over 90% of the country's cases in recent years.

The main vector in Honduras is *An. albimanus* and *P. vivax* is the predominant malaria-causing species. Notably, Honduras has the highest number of *P. falciparum* cases in the Central American sub-region. The most affected populations in Honduras are indigenous peoples, especially those of the Miskito ethnic group who reside in Gracias a Dios department, and those that move across the Nicaragua–Honduras border.

Microscopy is the predominant method of diagnosis; the number of slides read through active case detection more than doubled in 2014. To improve the quality of microscopic diagnosis and South–South collaboration, the country held a microscopist certification workshop in coordination with Guatemalan counterparts.

Given the absence of CQ resistance, CQ and PQ are used to treat both *P. falciparum* and *P. vivax* infections. Treatment times from the onset of symptoms cannot be compared reliably in Honduras, because measurements of time to treatment have changed over the years to include a confirmed diagnosis.

Honduras has expanded malaria diagnosis by RDTs in 23 remote areas where microscopy is unavailable. These areas include La Mosquitia and the northeastern department of Gracias a Dios, where more than 80% of all

*P. falciparum* cases are reported. Volunteer collaborators have been trained to use RDTs in these areas.

Following assessments of programmatic limitations, the country has updated its National Malaria Strategic Plan (PEN, by its Spanish acronym) for 2014–2017. The updated plan focuses on surveillance activities and case detection as well as expanded diagnosis, prompt treatment, and improved health promotion and communication. The country has also collaborated with Nicaragua to align its national treatment guidelines for the La Mosquitia region, ensuring that mobile populations in this area are able to continue the same treatment scheme regardless of where they are diagnosed.

In order to overcome bottlenecks and maintain adequate antimalarial medicine stocks, Honduras has institutionalized pharmaceutical supply management criteria for low-incidence areas developed with support from MSH/SIAPS, and considers the criteria in procurement planning.

Vector control methods used in Honduras include IRS and the distribution of ITNs. Honduras' national-level grant from GFATM, funds the distribution of ITNs and IRS, increased testing, early diagnosis and treatment, as well as regional surveillance strengthening. The use of IRS has increased in recent years, and currently protects more than 100,000 people.

The country's national reference laboratory has played a critical role in the EQAP for microscopy diagnosis, serving as the primary quality assurance laboratory for countries in Central America and the Caribbean. As a regional and sub-regional reference point, to which other countries can send filter paper with *P. falciparum* malaria samples, Honduras' laboratory has conducted testing for antimalarial resistance using molecular markers and in FY 2015 published the results of such testing.



## NICARAGUA

Malaria cases have decreased considerably in Nicaragua in the last two decades. The country achieved the MDG 6 objective in 2005.

Currently, the country's highest risk communities are concentrated in the remote La Mosquitia rainforest region of the North Autonomous Atlantic Region (RAAN, by its Spanish acronym) along the border with Honduras. The Miskito indigenous population that lives in this area accounts for a significant number of cases in the Central American sub-region. Malaria is also present in the northern Pacific coast and in the South Autonomous Atlantic Region (RAAS, by its Spanish acronym). Together, RAAN and RAAS account for 75% of the country's malaria cases, of which 90% are *P. falciparum*. Malaria transmission has historically been highest during the rainy season, which lasts from May to October. However, recently malaria transmission has been reported throughout the year.

Nicaragua's first line treatment for both *P. falciparum* and *P. vivax* infections is CQ and PQ. The vector control methods used in Nicaragua consist of IRS and ITNs. With the recent decrease in the use of IRS, more people are estimated to be protected by ITNs. The country regularly evaluates insecticide efficacy using the CDC bottle bioassay to ensure that recommended policies are effectively preventing malaria cases. Results from Waspan, Prinzapolka, and Chichigalpa during FY 2015 showed that the vector is still susceptible to insecticides etofenprox, alfacipermethrin, and deltamethrin.

The National Epidemiological Surveillance Program within Nicaragua's MOH tracks malaria at all levels of the country and has developed a national malaria surveillance information system for case reporting. The MOH foresees the need to strengthen diagnosis and treatment to ensure that municipalities that are certified as free of malaria are equipped to prevent reintroduction of the disease. In addition, Nicaragua institutionalized pharmaceutical supply management criteria for low-incidence areas in the country and considers them in procurement planning.

Cross-border collaboration has improved, as Nicaragua and Honduras joined efforts to mitigate the malaria burden in La Mosquitia on their common border. The countries have aligned their national treatment guidelines to guarantee mobile populations' access to treatment. Nicaragua continues to monitor for signs of antimalarial resistance through the collection of *P. falciparum* samples from sentinel sites, which are subsequently sent to the supranational laboratory in Honduras for molecular testing.

To ensure quality diagnosis in difficult-to-reach locations, Nicaragua periodically evaluates RDT use. Results from 12 locations were confirmed microscopically and indicated that RDT results are indeed accurate with 100% slide agreement. This validated the use of RDTs in remote areas.



## PANAMA

Panama had a 15.6% reduction in cases from 2000–2014. As of 2014, the MDG 6 objective had not been met, yet progress has been made.

Malaria transmission in Panama is concentrated in the Darién department, the country's Eastern region that borders Colombia and is home to several of Panama's indigenous ethnicities. Malaria surveillance and successful prevention efforts in this highly endemic region are considered critical to achieving the country's elimination goals. Although transmission occurs year-round, there is increased transmission during the rainy season from June–November.

*An. albimanus* is the primary malaria vector in Panama and *P. vivax* is the predominant plasmodium species, causing 99% of cases in the country. Panama's indigenous peoples are the most affected population, accounting for an estimated 78% of all cases in 2014. *P. vivax* infections are treated with CQ and PQ. The ACT artemether + lumenfantrine is the first line treatment for *P. falciparum* malaria.

A majority of patients receive treatment in more than 72 hours after onset of symptoms. The main vector control method used in Panama is IRS. In 2014, IRS protected nearly 28,000 people.

In order to expand access to diagnosis in Panama's remote locations, the country has approved the use of RDTs in parts of the country with large indigenous populations living in remote areas. Local non-medical personnel are expected to receive training on RDT use to ensure their appropriate use.

To strengthen cross-border collaboration, Panama and Colombia organized a joint-workshop to build bi-national capacities to address malaria on the border. During FY 2015, the two countries met regularly to share data and mediate challenges. Building on the Colombian model for training and certifying vector control personnel, Panama held a workshop in 2014 to assess the situation and need to develop a labor standards certification program and continued vector surveillance and control training in FY 2015. The Colombian model is now being adopted in Panama to improve the country's capacities for responding to malaria.

As Panama has reoriented its efforts towards malaria elimination, the country's MOH launched a *Master Plan for the Elimination of Malaria* to improve efforts with the aim of reaching zero cases by 2020. In addition, the country's malaria surveillance system was updated to incorporate strategies and indicators recommended in the National Malaria Strategic Plan.



## PERU

Malaria cases in Peru decreased by only 5% from 2000 to 2014. As a result of Peru's gradual increase in malaria cases since 2011, the country is not on track to meet MDG 6 targets for malaria morbidity. An overall increase in cases has led the regional malaria control entities to accelerate the implementation of workshops aimed at improving local-level capacities for malaria prevention, diagnosis, and control. Ninety-five percent of Peru's malaria cases are concentrated in the Loreto Region in the Peruvian Amazon, where marked seasonal transmission occurs from January to June.

Climate variables are thought to have played a key role in the recent increase of malaria cases in Peru by provoking increased mosquito breeding. *An. darlingi* is the main malaria vector in the country. *P. vivax* accounts for 83.1% of all cases in the country, while *P. falciparum* accounts for 16.9% of cases. CQ and PQ are the first line treatment for *P. vivax* infections, while artesunate + mefloquine combination therapy with primaquine is used to treat *P. falciparum* infections. Peru's regulatory agencies are currently analyzing the adoption of a fixed dose (artesunate + mefloquine) treatment scheme for uncomplicated *P. falciparum* cases. The vector control interventions used in Peru are IRS and ITNs. In 2014, its ITN coverage increased to protect more than 68,000 people, and in the same year 107,315 people were protected with IRS.

In October 2014, Peru's MOH hosted a country consultation on the Second Global Malaria Action Plan (GMAP2) for 2016–2025. The consultation meeting was organized together with the Roll Back Malaria (RBM) Partnership, PAHO/WHO and NAMRU-6, and informed the development of RBM's *Action and Investment to Defeat Malaria (AIM) 2016–2030*. That same month, a "Strengthening Malaria Microscopy Diagnosis" training workshop was conducted in Yurimaguas, Loreto Region. A total of 25 health professionals were trained in order to strengthen the Alto Amazonas-Yurimaguas Health Network's capacity to respond to the ongoing malaria epidemic in Loreto. Nationally, 33 microscopists were trained in diagnostic techniques and the various criteria needed to ensure accurate microscopy results in FY 2015.

Peru held a total of eight workshops in three priority provinces (Loreto, Maynas and Ramon Castilla) for training Community Health Agents (ACS, by its Spanish acronym) on diagnosis, case management, and other strategies to prevent and control malaria. Of the 371 ACS trained, 105 were indigenous.

In March 2015, AMI implementing partners traveled to Iquitos, Loreto as part of an expert consultation meeting. The meeting brought together national

and local-level partners from a variety of sectors to assess Loreto's situation and make policy recommendations for addressing the increased number of malaria cases. In follow-up, the country has updated and disseminated its *National Guidelines for Malaria Care and Severe Malaria in Peru* and held workshops in Loreto to provide public health personnel and volunteers with training in malaria prevention and control measures.

Peru advanced the institutionalization of the Three Level Approach to medicine quality control promoted under AMI, with a training workshop and partnership discussions with national universities in FY 2015.



## SURINAME

Between 2000 and 2014, Suriname reported a decrease of approximately 95% in malaria cases. Suriname’s “Decreasing the incidence of malaria in the populations of the interior of Suriname” program, started in 2006, contributed significantly to the country’s reduction in cases during that period. The program has focused on case detection, IRS and LLIN interventions in the interior of the country.

Most malaria transmission occurs in Suriname’s interior, specifically on the Suriname-French Guiana border. The country sees increased malaria rates at the end of the major rainy season (early August) and at the beginning of the major dry season (mid-August through October). *An. darlingi* is the primary vector in Suriname, and *P. falciparum* has been the primary species of infection.

Suriname began to use RDTs in 2007, and as of 2014 the number of RDTs examined almost equaled the number of blood slides examined microscopically. According to national guidelines, all positive RDTs need to be followed up by microscopy diagnosis. The treatment for *P. vivax* is CQ and PQ, while the treatment for *P. falciparum* cases is artemether + lumefantrine. Since 2010, the use of ITNs/LLINs has been declining in Suriname, with only 6,164 people protected by them in 2014.

Artisanal gold miners in Suriname are the population most affected by malaria. With the implementation of a new grant from GFATM that began in April 2015, Suriname’s Bureau of Public Health prioritized gold mining populations, with a particular focus on the French Guiana border. Suriname’s Infectious Diseases Board (formerly the National Malaria Board) serves as the country coordinating mechanism for the grant. In further efforts to improve access to malaria prevention, diagnosis, and treatment among gold miners, Suriname has increased coordination with NMCPs and national laboratories in French Guiana and Brazil.

Suriname has developed a new *Malaria Strategic Plan 2015–2020* oriented towards malaria elimination. The new strategic plan targets remote areas in the country and malaria transmission among migrant artisanal gold miners who are left without easy access to malaria diagnosis and treatment.

In 2014, Suriname completed an *in vivo* study to assess the efficacy of artemisinin. Results showed no evidence of artemisinin resistance as currently defined by the WHO, indicating that the ACT artemether+lumefantrine remained an efficacious treatment for *P. falciparum* malaria. Despite the

study's results, Suriname has continued to update and improve its laboratory capacity in order to conduct more sophisticated tests that can monitor for any signs of reduced efficacy using molecular markers. In addition, it has collected samples of *P. falciparum*, which are being stored in the country's malaria gene bank to be used for trainings in future years.

Suriname has created a new malaria information system to ensure that all cases are reported individually, in a single system. As a result of the restructuring of the malaria information system, Suriname has begun to see improved quality and timeliness of epidemiological surveillance data. Besides national surveillance system strengthening, data sharing has been prioritized. Countries in the Guiana Shield have developed a report format to foster improved information sharing.

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